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Pennsylvania's **SUPPLY/ DEMAND GAP ANALYSIS**

A report for Pennsylvania's
State System of Higher Education

2016



Pennsylvania's
STATE SYSTEM
of Higher Education

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GLOSSARY OF TERMS

The following descriptions provide a point of reference to understand terminology as well as the types of data and analysis undertaken in this study, reflecting historic and contemporary narratives.

Fastest Growing: A term used to describe the relative growth (percent change) of an industry or occupation in a given time period. Fastest growing industries and occupations in this study are identified by the highest relative change in jobs between 2014 and 2024.

High Demand: A term used to describe the demand for workers in a given occupation. High demand occupations are identified as having the highest number of new and replacement jobs projected between 2014 and 2024.

Industry Change: A measure of the change in employment within an industry, used to identify whether an industry is growing or declining, as well as the rate of change. Projected changes lay out expectations of growth/decline for specific industries.

Job Postings: The number of unique (de-duplicated) online postings for a job in a given occupation.

Location Quotient: A comparative statistic used to calculate the relative employment concentration of a given industry or occupation against the average employment of the industry in a larger geography (for example, countrywide). Industries with a higher location quotient (usually greater than 1.2) indicate that the region has a comparative advantage or specialization in the production of that good or service or has a high degree of specialization within its workforce.

New and Replacement Jobs: A demand-side estimate of the number of job openings in an occupation that result from new job growth as well as replacement demand. Replacement demand comprises occupation job leavers based on separations, retirement, and death.

Occupation Jobs: A measure of employment within an occupation category, used to identify which occupations have been growing or declining, as well as the rate of change. Projected changes lay out expectations of growth/decline for specific occupation categories.

Sub-regions: Geographic areas within Pennsylvania defined for more focused workforce and education gap analyses. Sub-regions were determined primarily on Partnerships for Regional Economic Performance (PREP) boundaries. PREP is Pennsylvania's network of business assistance partners, designed to help companies start, grow, and prosper. Please refer to Appendix A for mapping of the Sub-regions and PREP boundaries.

ACRONYMS USED

ACS: American Community Survey

BLS: Bureau of Labor Statistics

CIP: Classification of Instructional Programs

DOE: United States Department of Education

DOL: United States Department of Labor

EMSI: Economic Modeling Specialists International

CEW: Center on Education and the Workforce (Georgetown University)

IPEDS: Integrated Postsecondary Education Data System

LAUS: Local Area Unemployment Statistics

LEHD: Longitudinal Employment and Housing Dynamics

NAICS: North American Industry Classification System

NCES: National Center for Education Statistics

OES: Occupational Employment Statistics

O*NET: Occupational Network

PUMS: Public Use Microdata Sample

QCEW: Quarterly Census of Employment and Wages

SOC: Standard Occupational Classification

EXECUTIVE SUMMARY

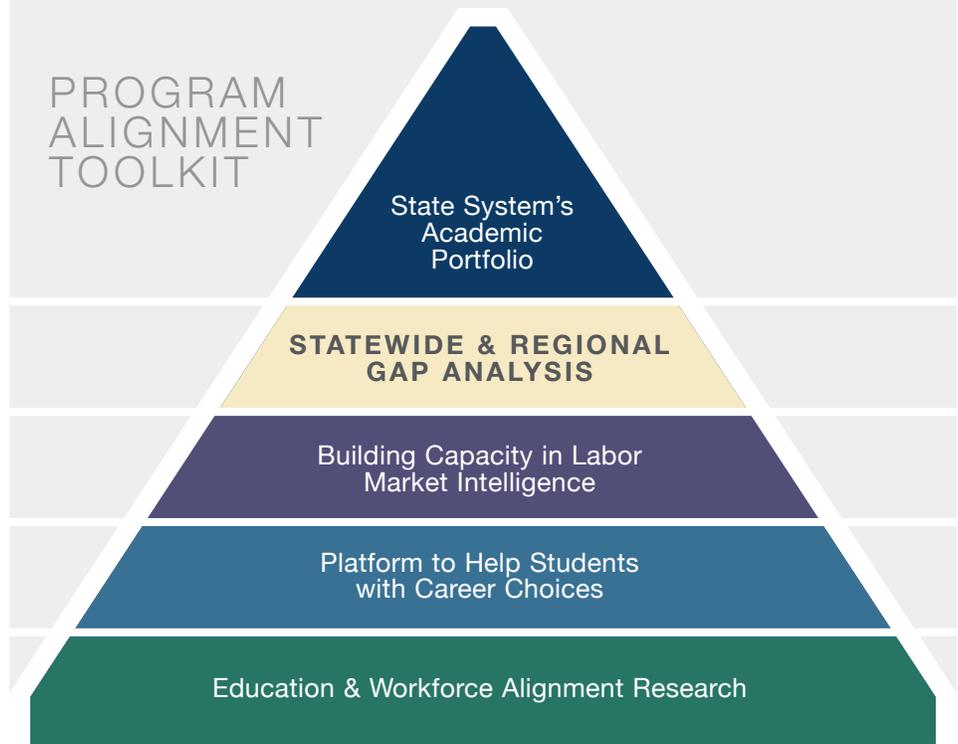
In support of “Rising to the Challenge 2020,” Pennsylvania’s State System of Higher Education (State System) commissioned thorough labor market research to produce a data-driven education supply-workforce demand gap analysis report. The State System Gap Analysis project is a means to understand the big economic picture for the commonwealth and its regions. Knowing the supply of graduates in a given area and the relative employer demand for those graduates helps university stakeholders evaluate the economic eco-system and determine areas that deserve their attention.

To complete the Supply/Demand Gap Analysis, the State System collaborated with Georgetown University’s Center on Education and the Workforce and Oxford Economics to provide key economic research and projections as well as to develop an education program to occupation classification crosswalk that better reflects the employment destinations of Pennsylvania’s post-secondary program completers.

The gap analysis is only one component of a larger resource base that the State System and universities can use for strategic planning, engagement with businesses and support for current and prospective students. Other factors not included in this analysis that could influence decision-making in these areas include higher education trends, student aspirations, university goals, live data analysis, and direct employer input. The purpose of this education supply/demand gap analysis is to identify areas where education output in Pennsylvania does not meet market need (as defined by employer demand for new and replacement jobs), or if there exists a high surplus of program graduates in the labor market (as compared to employer demand for those graduates).

The results of the State System’s Gap Analysis project will become part the State System’s Program Alignment Toolkit (see Fig. on the next page)—an infrastructure of resources that are being created to assist the State System’s universities to increase their individual and collective impact on Pennsylvania’s economy. The Program Alignment Tool-kit complements the existing Business Intelligence Environment the State System has created to support data driven decision-making. This environment includes forward-thinking, data-rich projects such as the Financial Risk Dashboard, the Data Warehouse project, and the Upcoming Student Success Dashboard.

Pennsylvania's State System of Higher Education Program Alignment Toolkit outline



Questions in three primary areas guided the research contained in the State System's Gap Analysis project:

1. Evaluating Pennsylvania's employer demand, now and into the future

- How are Pennsylvania's industries changing and which sectors are driving new job growth?
- How are Pennsylvania's occupations changing and which skilled occupations show the highest future demand?

2. Evaluating Pennsylvania's education supply

- What is the current education output from Pennsylvania's institutions of higher education?

3. Evaluating the Gap

- What is the alignment between occupation demand and education program output?

- What is the excess employer demand for occupations in the commonwealth?

The following sections highlight key findings from each of the primary research areas.

Pennsylvania's Employer Demand

The demand for skilled workers in Pennsylvania is growing faster than the demand for unskilled labor. The Pennsylvania economy had 5.6 million jobs in 2014 which are projected to grow to 6.2 million in 2024—an increase of more than 536,200 jobs or a 9.5 percent change. Of the 6.2 million jobs the commonwealth is projected to have in 2024, 50 percent will be skilled occupations, requiring some amount of post-secondary education preparation. These are defined as skilled jobs or skilled occupations in the State System's Gap Analysis project using terminology from the O*NET program—the nation's primary source of occupational information, including standardized descriptors of skill levels, education requirements and job duties. Central to the project is the O*NET database, which contains information on hundreds of occupation classifications. To be considered skilled, an occupation must have an O*NET Job Zone code of Three, Four or Five.¹

Furthermore, it is important to note that from 2014 to 2024, the share of jobs in Pennsylvania that require some post-secondary education will increase, indicating employer demand for skilled workers will continue to grow. In fact, the growth in jobs that align to post-secondary education in 2024 is projected to be 10.9 percent as compared to 8.1 percent for those that typically do not require post-secondary education.

Industry Demand

Industry sectors that indicate significant levels of job growth include:

- **Healthcare and social assistance** with nearly 190,000 new jobs projected between 2014 and 2024 (19% job growth),
- **Professional and technical services and management of companies and enterprises** are projected to add over 78,700 new

¹ A Job Zone is a group of occupations that are similar in how much education people need to do the work, how much related experience people need to do the work, and how much on-the-job training people need to do the work. The Job Zones range from 1 (lowest) to 5 (highest). Job Zones Three, Four, and Five require some level of post-secondary education. For more information, please visit: <https://www.onetonline.org/help/online/zones>

jobs combined (17% job growth)—which will require talent across various business disciplines to support this growth,

- **Accommodation and food services** are projected to add 43,400 new jobs between 2014 and 2024 (10% job growth).

The growth in these sectors as well as other industries will drive demand for workers to fill various occupational roles. When evaluating future demand, occupation projections include both new job growth, as well as the demand associated with replacing workers who retire or otherwise permanently leave the occupation. When new jobs are combined with replacement job demand, a more holistic picture of demand can be analyzed.

Occupation Demand

From an occupation perspective, Pennsylvania's employment projections indicate that between 2014 and 2024 employers will require nearly 212,700 new and replacement jobs annually to sustain productivity and growth.² This figure includes both low-skilled and skilled occupations and it represents a significant need for workers over the coming years in Pennsylvania.

In Pennsylvania, top skilled occupations that align more closely to university-level education (Job Zone Four and Five) and show the highest demand for new and replacement jobs between 2014 and 2024 include:

- **Accountants and auditors** with almost 23,700 new and replacement jobs projected;
- **General and operations managers** with 22,400 projected new and replacement openings;
- **Sales representatives, services, all other** with 16,700 projected new and replacement job openings;
- **Secondary school teachers** projected to need 14,000 replacement jobs; and
- **Computer systems analysts** which show 12,500 projected new and replacement jobs.

Demand for these skilled occupations as well as many others call for supply from post-secondary education institutions in Pennsylvania.

² New and replacement jobs refer to new job creation that result from business growth, as well as replacement demand that result from retirement or job separation.

Pennsylvania's Education Supply

According to the National Center for Education Statistics (NCES), Pennsylvania is home to approximately 400 post-secondary institutions.³ These institutions have over 800,000 enrolled students and graduated on average 166,000 students per year from 2011 to 2013 with an associate's degree or higher.⁴

Pennsylvania's State System of Higher Education is a large contributor to the total number of degree completions. The State System produces approximately one in five (21%) of the total bachelor's degrees in the state.⁵ Furthermore, the State System enrolls approximately 18% of Pennsylvania's four-year institutions' learners and this number has remained steady for the past several academic years.

A number of key data findings emerge when looking at degree production at the associate's degree, bachelor's degree and graduate degree level.

Associate's Degrees

Over 100 different Pennsylvania institutions offer a range of associate's degree programs, as reported by the National Center for Education Statistics (NCES).⁶ From 2011 to 2013, institutions in Pennsylvania awarded, on average, nearly 29,300 associate's degrees.

Top program areas for associate's degrees in Pennsylvania include:

- **Health professional and related programs** with 8,091 average annual completions (28% of all associate's degrees),
- **Business, management, marketing and related support services** with 3,329 average annual completions (13% of all associate's degrees),
- **Liberal arts and sciences, general** with 3,609 average annual completions (12% of all associate's degrees),

3 This number includes the location of a physical campus/structure with learner enrolment as reported to NCES. Institutions with extension campuses that report enrollment at their main campus may not be captured within this list.

4 This number is the 3-year average completions in Pennsylvania from 2011 to 2013 as reported to NCES.

5 Georgetown's Center on Education and the Workforce analysis of degree production in the Pennsylvania Baccalaureate Sector – October 2015.

6 This number includes the location of a physical campus/structure as reported to NCES. Institutions with extension campuses that report to their main campus may not be captured within this list.

- **Computer and information sciences and support services** with 1,937 average annual completions (7% of all associate's degrees), and
- **Engineering technologies and engineering-related fields** with 1,851 average annual completions (6% of all associate's degrees).

Bachelor's Degrees

Over 150 different Pennsylvania institutions offer a range of bachelor's degree programs, as reported by the National Center for Education Statistics (NCES).⁷ From 2011 to 2013, institutions in Pennsylvania awarded, on average, nearly 90,700 bachelor's degrees.

Top program areas for bachelor's degrees in Pennsylvania (2011 to 2013) include:

- **Business, management, marketing and related support services** with 17,252 average annual completions (19% of all bachelor's degrees),
- **Health professional and related programs** with 9,506 average annual completions (10% of all bachelor's degrees),
- **Social sciences** with 6,734 average annual completions (7% of all bachelor's degrees),
- **Education** with 5,986 average annual completions (7% of all bachelor's degrees), and
- **Visual and performing arts** with 5,500 average annual completions (6% of all bachelor's degrees).

Graduate Degrees

Over 100 different Pennsylvania institutions offer a range of graduate degree programs, as reported by the National Center for Education Statistics (NCES).⁸ From 2011 to 2013, institutions in Pennsylvania awarded, on average, over 46,200 graduate degrees.

7 This number includes the location of a physical campus/structure as reported to NCES. Institutions with extension campuses that report to their main campus may not be captured within this list.

8 This number includes the location of a physical campus/structure as reported to NCES. Institutions with extension campuses that report to their main campus may not be captured within this list.

Top program areas for graduate degrees in Pennsylvania (2011 to 2013) include:

- **Education** with 9,912 average completions (21% of all graduate degrees).
- **Health professional and related programs** with 9,865 average completions (21% of all graduate degrees).
- **Business, management, marketing and related support services** with 7,733 average completions (17% of all graduate degrees),
- **Engineering** with 2,659 average completions (6% of all graduate degrees), and
- **Legal professions and studies** with 2,015 average completions (4% of all graduate degrees).

Matching Employer Demand to Education Supply

When education program completions—supply—are matched to relevant demand for occupations that align to the program degree, a comparative analysis of difference between occupation demand and program supply can be achieved with the following implications:

- An excess demand gap indicates there are not enough education program completers to meet the projected new and replacement job demand of a matched occupation on an annual basis.
- A supply surplus gap occurs if the number of education program completers is greater than the new and replacement demand of a matched occupation on an annual basis.

A gap analysis comparing educational supply and occupational demand serves as a critical first step in efforts to align education programs with the workforce needs of Pennsylvania employers. It provides a data-driven perspective of employer demand (new and replacement job openings of occupations across the state) and post-secondary education supply (degree production by program and level).

While the State System's Gap Analysis project is critical to understanding the connections between education programs and occupations, it is important to note a few caveats of this Gap Analysis report:

- When considering making adjustments to programs in degree areas related to occupations displaying gaps, further research should be

considered to confirm the extent of alignment needed to arrive at equilibrium with the labor market.

- Government data that captures labor market demand lags real-time employer demand as well higher education industry trends. As such, the gap analysis findings may lag these market changes.
- This analysis only focuses on program output as a supply pool (i.e. new graduates). However, regional workforces comprise additional pools of supply—specifically: employed workers, skilled unemployed workers, and skilled underemployed workers. When evaluating gaps, this analysis focuses on new and replacement demand, as opposed to job churn. This helps to mitigate some of the issues involving the employed workforce.⁹

To make the connection between employer demand and education supply, a crosswalk between the taxonomy of occupations (Standard Occupation Codes, or SOC) and major programs (Classification of Instructional Program or CIP) is required. The State System’s Gap Analysis project conducted original research to enhance the traditional taxonomy of major program to occupation crosswalk¹⁰ using American Community Survey data that demonstrate a broader spectrum of connections between education programs and occupations. This hybrid crosswalk connected the CIP and SOC using both the NCES and Pennsylvania standard crosswalks and the additional real-world connections using the American Community Survey.

Pennsylvania’s Gap

This section focuses the demand gaps and supply surpluses for skilled occupations in Pennsylvania (Job Zones Three, Four and Five) as characterized by O*NET.

9 Replacement jobs include retirements, deaths, and other workers who permanently leave an occupation. Therefore, when an individual leaves one occupation for the same job elsewhere in PA, they are not inflating projections of replacement demand. For example, consider two accountants at two different firms. One accountant quits in order taking a job at Firm A, while the other accountant quits taking a job at Firm B. In this scenario, no annual openings for accounting jobs will occur as the current employed workforce filled the demand through normal job churn.

10 The existing crosswalks available include a national NCES crosswalk and a state crosswalk specific to Pennsylvania. Additional connections were made using data available in the U.S. Census’ American Community Survey (ACS). The benefits of the ACS approach include: A better capture of demand for college majors within an occupation classification, a reality-driven process to connect liberal arts degrees to occupations, a reality-driven reflection of education attainment distribution by degree level demonstrating that a range of skill levels exist within occupation classification, and a regionalized crosswalk that better reflects the competition for jobs in Pennsylvania and the surrounding region.

The gap analysis findings are presented in two categories:

- Occupations at the statewide level that demonstrate excess employer demand (demand gap).
- Occupations at the statewide level that demonstrate supply surpluses (supply gap).

1. Excess Demand Gaps in Pennsylvania's Skilled Occupations

Excess demand gaps for skilled occupations cover occupations in Job Zones Three, Four and Five. The degree programs that align to these occupations span associate's degrees through graduate degrees. Recall that a demand gap exists where the regional supply of talent is insufficient to support the workforce needs of businesses located there. The top excess demand gaps are identified by the size of the annual gap. Top skilled occupation demand gaps for occupations aligning to associate's degrees¹¹ include:

- **Registered nurses**—an annual demand gap of 624 with a supply/demand ratio of 0.9 completions per job opening,
- **Maintenance and repair workers, general**—an annual demand gap of 364 with a supply/demand ratio of 0.1 completions per job opening,
- **Licensed practical and licensed vocational nurses**—an annual demand gap of 346 with a supply/demand ratio of 0.2 completions per job opening,
- **Dental hygienists**—an annual demand gap of 264 with a supply/demand ratio of 0.4 completions per job opening,
- **Industrial machinery mechanics**—an annual demand gap of 143 with a supply/demand ratio of 0.1 completions per job opening,

Top skilled occupation demand gaps for occupations aligning to bachelor's and graduate degrees¹² include:

- **Accountants and auditors**—an annual demand gap of 494 with a supply/demand ratio of 0.8 completions per job opening,
- **Sales representatives, services, all other**—an annual demand gap of 439 with a supply/demand ratio of 0.6 completions per job opening,

¹¹ Occupations in Job Zone Three

¹² Occupations in Job Zones Four and Five

- **Computer system analysts**—an annual demand gap of 385 with a supply/demand ratio of 0.6 completions per job opening,
- **Computer programmers**—an annual demand gap of 348 with a supply/demand ratio of 0.6 completions per job opening,
- **Software developers, applications**—an annual demand gap of 270 with a supply/demand ratio of 0.8 completions per job opening,

These occupations may present opportunities for either program expansion or development within Pennsylvania State System universities.

2. Supply Surplus Gaps in Pennsylvania’s Skilled Occupations

A number of occupations demonstrate a surplus of degree completions in Pennsylvania. The top supply surpluses within Pennsylvania cover a broad range of both technical and non-technical occupations. When considering program changes in degree areas related to occupations displaying a supply surplus, further research should be considered to confirm the extent of alignment needed to arrive at equilibrium with the labor market. The top supply surplus gaps are identified by the size of the annual gap.

The following skilled occupations that show the largest nominal supply surpluses include:

- **Police and Sheriff’s Patrol Officers**—an annual supply surplus of 923 with a supply/demand ratio of 2.8 completions per job opening
- **Secondary School Teachers**—an annual supply surplus of 884 with a supply/demand ratio of 1.6 completions per job opening
- **Managers, All Other**—an annual supply surplus of 864 with a supply/demand ratio of 6.0 completions per job opening
- **Lawyers**—an annual supply surplus of 862 with a supply/demand ratio of 2.3 completions per job opening
- **Computer Network Support Specialists**—an annual supply surplus of 857 with a supply/demand ratio of 10.4 completions per job opening

These findings are further described in the Supply/Demand Gap Analysis Technical Report. The report provides a data-driven foundation for program planning and alignment in order to drive economic value and career success within the Commonwealth. The content of this report is designed to be a starting point and resource for program evaluation and planning.

1. INTRODUCTION

Pennsylvania's State System of Higher Education (State System) comprises 14 universities, four branch campuses, multiple regional centers and the McKeever Environmental Learning Center.¹³ The universities are located in rural, suburban, and small-town settings around Pennsylvania. The State System's two educational hubs (with locations in Harrisburg, the Dixon University Center, and Philadelphia, State System @ Center City) offers academic programs through a consortium of public and private colleges and universities.

Per Act 188 of 1982, the State System's mission "is the provision of instruction for undergraduate and graduate students to and beyond the master's degree in the liberal arts and sciences, and in the applied fields, including the teaching profession." In doing so, the State System's purpose is "to provide high quality education at the lowest possible cost to students."¹⁴ Analysis and understanding of the economy and workforce the State System supports, as well as the alignment between education programs and talent needs further advances the State System's mission and philosophy. This is the goal of the State System's Gap Analysis Project. It enables effective and targeted strategies and decision-making, grounded in data-driven evidence. Through two earlier reports—'Pennsylvania's Workforce Characteristics Report'¹⁵ and 'Degrees of Value: College Majors and the Pennsylvania State System's Contribution to the Workforce'¹⁶— foundation was laid for the State System' Gap Analysis project. This supply/demand gap analysis report establishes the framework to 'crosswalk' education programs with relevant occupations. This crosswalk establishes the relationship between the workforce employed in specific occupations and the degrees that those workers earned. The goal of this report

13 One of the State System's entities, System-wide Functions and Services, is primarily located at the Dixon University Center in Harrisburg and include: System-wide shared administrative services; System leadership functions of the Chancellor and Board of Governors; some System-wide initiatives and grants managed on behalf of the universities; and the academic, student, and facilities support for the multi-university sites in Harrisburg and Philadelphia.

14 Source: The State System's Economic and Employment Impact on the Commonwealth of Pennsylvania – released April 15, 2015

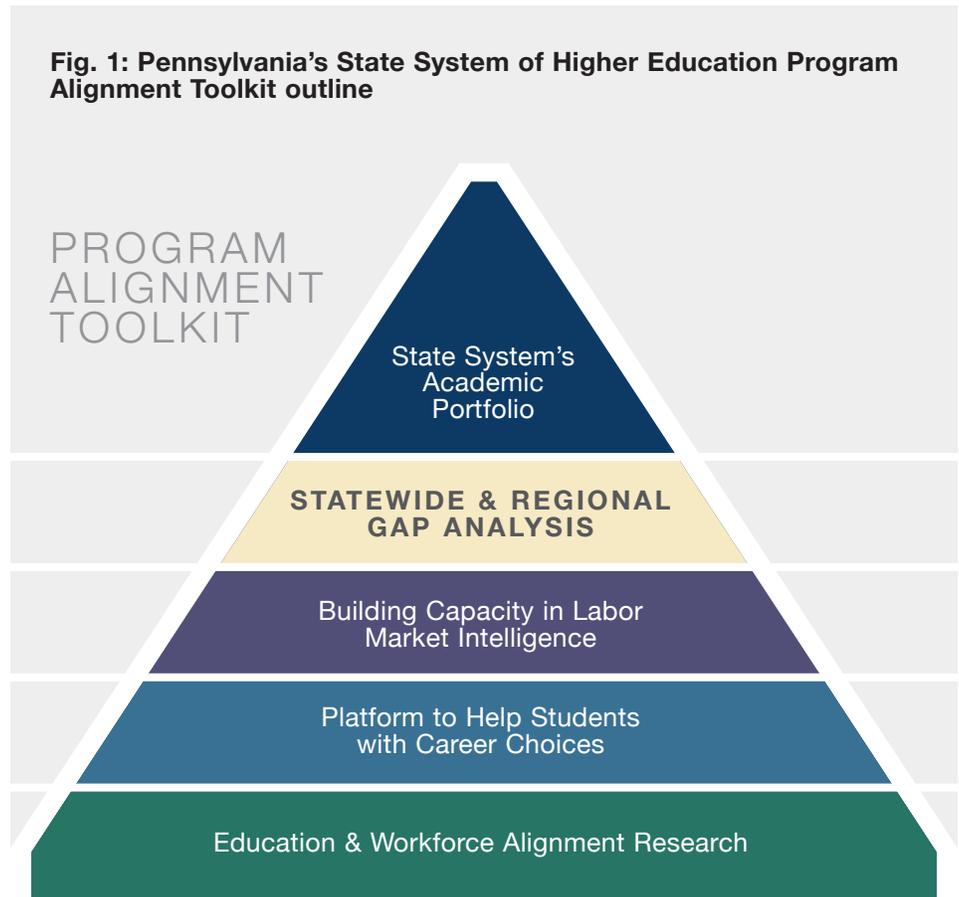
15 Pennsylvania's Workforce Characteristics Report—a collaboration between the Pennsylvania State System of Higher Education and Oxford Economics with input from Georgetown University's Center on Education and the Workforce, provides detailed demand-side projections for occupations within Pennsylvania, as well as other labor market intelligence for skilled occupations

16 *Degrees of Value: College Majors and the Pennsylvania State System's Contribution to the Workforce* is an education and workforce analysis of the Commonwealth with a particular emphasis on the State System's Universities' output produced by Georgetown University's Center on Education and the Workforce.

is to understand this relationship in the context of Pennsylvania's projected skilled workforce needs and education output.

This study and the broader set of deliverables under the State System's Supply/Demand Gap project will assist universities and education planners by providing an infrastructure of resources for internal planning, as well as external engagement. Understanding key gaps and surpluses within Pennsylvania helps to better align policy and strategic direction in order to continue supporting the talent needs of the Commonwealth.

The results of the State System's Gap Analysis project will become part the State System's Program Alignment Toolkit (see Fig. 1 below) — an infrastructure of resources that are being created to assist the State System's universities to increase their individual and collective impact on Pennsylvania's economy. The Program Alignment Tool-kit complements the existing Business Intelligence Environment the State System has created to support data driven decision-making. This environment includes forward-thinking, data-rich projects such as the Financial Risk Dashboard, the Data Warehouse project, and the Upcoming Student Success Dashboard.



ABOUT PENNSYLVANIA STATE SYSTEM OF HIGHER EDUCATION

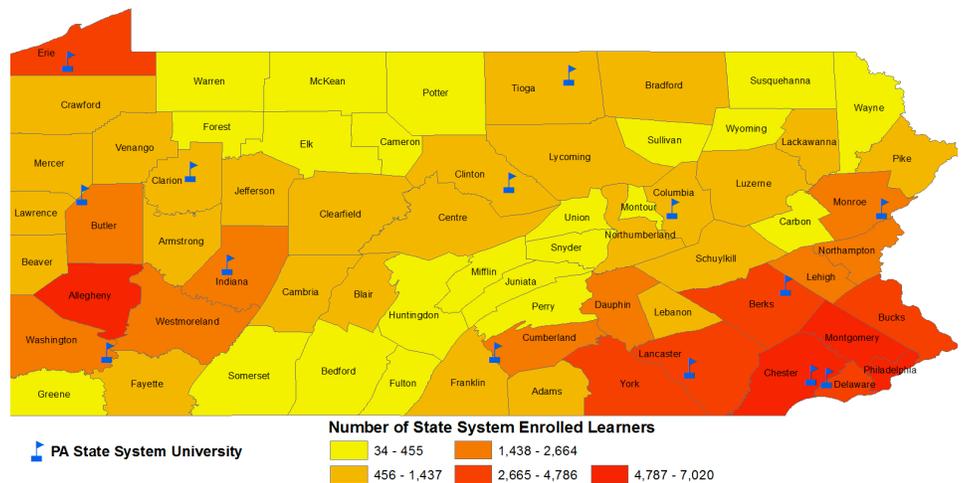
Pennsylvania's State System of Higher Education was established by statute on July 1, 1983, although the 14 universities that comprise the State System have a much longer history dating back to the 19th century.

Today, the State System serves over 110,000 students, with learners coming from every county in Pennsylvania, making it among the largest providers of higher education in Pennsylvania and the United States. It also employs more than 12,000 faculty and staff, making it one of the largest employers in the Commonwealth. Nearly 88% of students enrolled in the State System are from Pennsylvania and the vast majority of students remain after graduation—about 80%.*

The State System generates more than \$6.7 billion in annual economic activity within Pennsylvania. This economic value in turn supports approximately 62,000 jobs through the State System's direct employment, operational expenditures with vendors and suppliers across Pennsylvania, and spending of those who are employed as a result of the State System's operations.

* Pennsylvania's State System of Higher Education – Student Data Fact Center
 ** The State System's Economic and Employment Impact on the Commonwealth of Pennsylvania – Released April 15, 2015

Fig. 2: State System Learner Enrollment by County – Fall 2014



Source: Pennsylvania State System of Higher Education

1.1 Goal of the Supply/Demand Gap Analysis Report

The Supply/Demand Gap Analysis Report provides a data-driven perspective of employer demand (growing occupations across the Commonwealth) and post-secondary education supply (degree production by program and level). It builds on information provided in an earlier State System report entitled “Pennsylvania’s Workforce Characteristics Technical Report.” The report also contains a set of economic, workforce, demographic, and socio-economic information to contextualize the Supply/Demand Gap Analysis. The Supply/Demand Gap Analysis Report will assist the state system universities with strategic engagement, program development and evaluation, student engagement, and marketing. The Supply/Demand Gap Analysis Report contains research specific to Pennsylvania in the following areas:

- Industry sector and occupation job changes and projections for new and replacement job demand to 2024,
- Size of education production by broad degree category,
- Links between occupations and education programs, and
- Analysis of gaps at the occupational level (presenting a structure to review occupations that have excess employer demand as well as those that have surplus).

While the State System’s Gap Analysis project is critical to understanding the connections between education programs and occupations, it is important to note a few caveats to this Gap Analysis report:

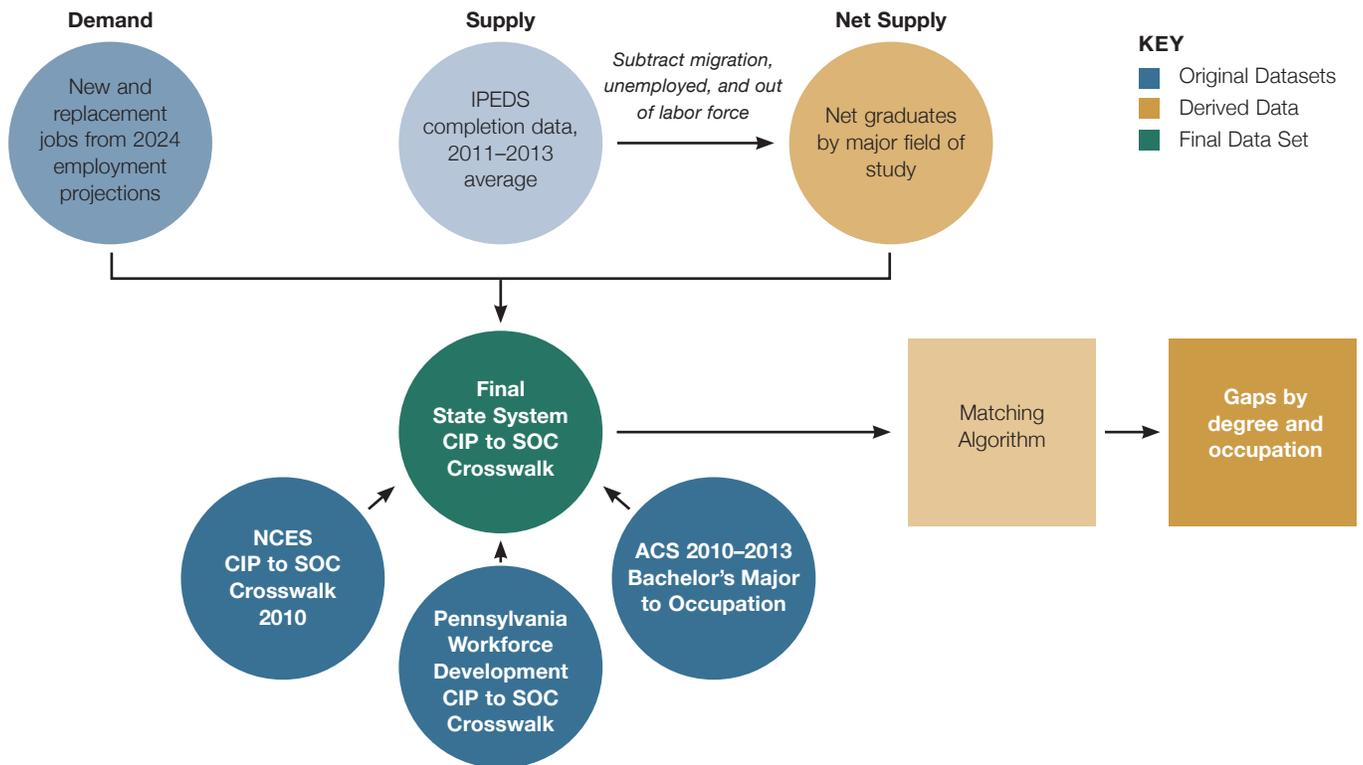
- When considering making adjustments to programs in degree areas related to occupations displaying gaps, further research should be considered to confirm the extent of alignment needed to arrive at equilibrium with the labor market.
- Government data that captures labor market demand lags real-time employer demand as well higher education industry trends. As such, the gap analysis findings may lag these market changes.
- This analysis only focuses on program output as a supply pool (i.e. new graduates). However, regional workforces comprise additional pools of supply—specifically: employed workers, skilled unemployed workers, and skilled underemployed workers. When evaluating gaps, this analysis focuses on new and replacement demand, as opposed to job churn. This helps to mitigate some of the issues involving the employed workforce.

ABOUT GAP ANALYSIS

A gap analysis comparing educational supply and occupational demand serves as a critical first step in efforts to align education programs with the workforce needs of Pennsylvania employers. A gap analysis provides a data-driven perspective of demand and supply, which can be connected to a larger process of program evaluation and strategic planning, engagement with employers, and student career guidance. The analysis itself is not the solution, but can lend credible insight to guide decision-making at the strategic level.

Figure 3 provides a high-level flow chart of the process to calculate gaps/surpluses. A methodological description of the supply/demand gap modeling process can be found in Appendix E.

Fig. 3: Overview of the gap analysis methodology for the State System



Source: Oxford Economics

1.2 Structure of the Gap Analysis Report

This Supply/Demand Gap Analysis report for Pennsylvania is organized as follows:

- Section 1** Introduction and background information.
- Section 2** Overview of changes in Pennsylvania's industry sectors from a historic and projected point of view, as well as fast growing and most competitive industries.
- Section 3** Overview of changes in Pennsylvania's occupations including additional detail on skilled occupations as well as high demand occupations, the fastest growing occupations, and occupations that are highly concentrated in Pennsylvania.
- Section 4** Evaluation of output of education programs at the associate's, bachelor's, and graduate level, as well as the State System's contribution to the total output of bachelor's degrees.
- Section 5** Comparison of demand for skilled occupations against supply of relevant education program completions.
- Section 6** Conclusion and areas of future research
- Section 7** Additional information on the Gap Analysis project and contributing organizations.
- Section 8** List of key data sources used in the report.

While the main body of this report provides a high level summary, the Appendices provide an abundance of information for those seeking additional detail.

Appendix A provides a map of the state sub-region boundaries along with economic development and workforce boundaries as defined by PREP and WIA.

Appendix B provides a description of O*NET Job Zone codes.

Appendix C provides further detail about strong, limited and weak connections between education programs and occupations

Appendix D provides detailed industry employment and projections to 2024.

Appendix E provides a crosswalk and gap analysis methodology.

Appendix F provides gap analysis results for over 500 occupations

Appendix G provides the crosswalk of programs to occupations.

2. INDUSTRY PROFILE OF PENNSYLVANIA

Industry growth is a key driver of demand for occupations and talent. Hence, understanding the structure of Pennsylvania's industry sectors offers valuable insights into career opportunities that exist. As the State System implements strategies to increase the economic competitiveness of its workforce and ultimately the economic competitiveness of the state, it is important to understand the connection between occupations and industry jobs. The state's workforce changes and labor demand are presented in multiple ways in this section including:

- Major (2-digit) industries,
- Largest 4-digit industries in 2014,
- Largest growth 4-digit industries from 2014 to 2024,
- Fastest growing 4-digit industries from 2014 to 2024, and
- Industries (4-digit) with high location quotient (or concentration) in 2014.

This section explores the current strengths in Pennsylvania's economy by industry and examines trends that may affect industry structure in the coming years. A table of all 4-digit North American Industrial Classification System (NAICS) sector employment and projections prepared specifically for State System's Gap Analysis project can be found in Appendix D.

The following sub-section begins the analysis by examining major industry groups in Pennsylvania in 2014 and projected growth to 2024.

2.1 Major Industry Groups

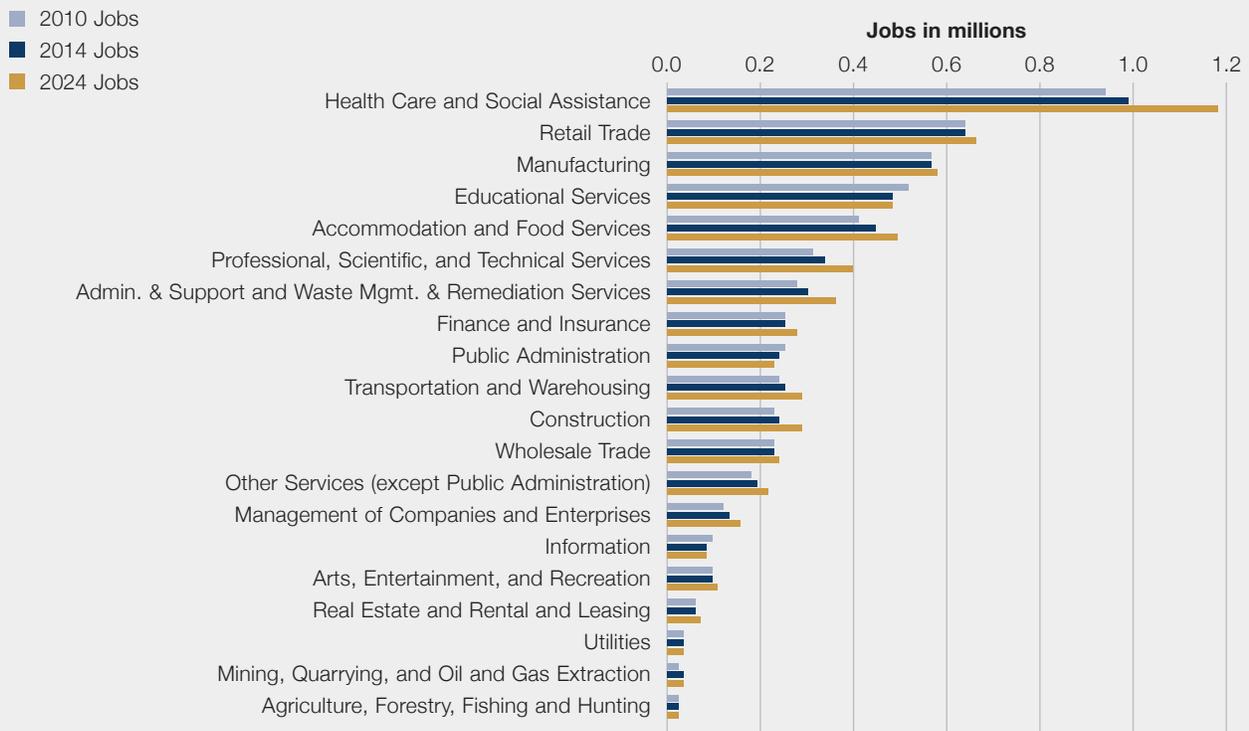
In 2014 the largest industry sectors include education and health services, trade, transportation and utilities, and professional and business services. As can be seen in Fig. 4, health care and social assistance account for the most jobs (over 983,800 jobs), followed by retail trade (about 637,700 jobs), manufacturing (almost 567,800 jobs) and education services (about 482,800 jobs). Furthermore, each of these industry sectors, except education services, has added a significant number of new jobs between 2010 and 2014 (approximately 61,100 new jobs), reflecting both economic recovery from the

recession, as well as continued sector growth, stemming in part from the place-based competitiveness of these sectors in the Northeast US.¹⁷

Projections indicate that healthcare and social assistance will add an additional 190,000 new jobs between 2014 and 2024 (18% growth). Professional and technical services and management of companies and enterprises are projected to add nearly 78,700 new jobs combined (nearly 17% growth)—which will require talent in various business disciplines to support this growth.

Substantial economic transformation is taking place across several sectors. While many sectors have experienced moderate or strong growth over the past several years, noted exceptions of job decline include government, education and information. The causes of these reductions may differ. For example, reductions in government employment could reflect changes in legislative priorities and budgets, while reductions in information are largely due

Fig. 4: Employment by Major Industry, 2010, 2014 & 2024



Source: BLS (QCEW); Pennsylvania Department of Labor & Industry; Oxford Economics Projections

¹⁷ The strong transportation network linkages in the Philadelphia metropolitan area, as well as strong economic ties to other areas outside of Pennsylvania, such as New York and Washington D.C. enables a high degree of place-based competitiveness for the region.

to the decline in newspaper and book publishers. This, however, is offset by substantial growth in other sectors discussed earlier.

Fig. 4 depicts the number of jobs in 2010, 2014 and projections out to 2024 for each of the broad industry sectors.

2.2 Largest 4-Digit Industries

The largest 4-digit industries in Pennsylvania are identified by the volume of 2014 employment. Industry sectors that employ the most workers are critical foundations to a statewide economy. In Pennsylvania, the ten largest 4-digit industry classifications employed 31% of total jobs in 2014 (1.7 million jobs out of 5.6 million total statewide jobs). The largest industries include restaurants, elementary & secondary schools and medical and surgical hospitals, employing almost 876,500 jobs in 2014. Fig. 5 below displays Pennsylvania’s largest 4-digit industry sectors in 2014 and projections to 2024.

Fig. 5: Pennsylvania’s Largest 4-Digit Industries and Projections, 2014-2024

Industry Title	2014 Jobs	2024 Jobs	New Jobs 2014-2024	% Change 2014-2024
Restaurants and Other Eating Places	334,874	368,731	33,857	10.1%
Elementary and Secondary Schools	293,433	284,320	-9,113	-3.1%
General Medical and Surgical Hospitals	248,181	271,788	23,607	9.5%
Colleges, Universities, and Professional Schools	147,018	152,009	4,991	3.4%
Management of Companies and Enterprises	132,758	151,533	18,775	14.1%
Grocery Stores	126,049	127,480	1,431	1.1%
Executive, Legislative, and Other General Government Support	116,028	111,895	-4,133	-3.6%
Individual and Family Services	115,858	156,278	40,420	34.9%
Offices of Physicians	110,432	120,550	10,118	9.2%
Employment Services	108,361	142,374	34,013	31.4%
Total, Ten Largest	1,732,992	1,886,958	153,966	8.9%

Source: BLS (QCEW); Pennsylvania Department of Labor & Industry; Oxford Economics Projections

2.3 Largest Growth 4-Digit Industries

The largest sectors are not necessarily generating the most new jobs in Pennsylvania. Projections indicate that the top ten largest growth industries in Pennsylvania will add almost 239,500 new jobs between 2014 and 2024. Some industries in the top ten largest growth list employ several occupations that require university-level skill specializations. For example,

- **Management of companies and enterprises** requires numerous accountants and auditors, operation managers, financial managers, marketing specialists and human resource specialists. Projections indicate that management of companies and enterprises is slated to grow from about 132,750 jobs in 2014 to 152,050 jobs in 2024.
- **Computer systems design and related services** employ many skilled occupations such as software developers, computer system analysts, computer programmers and computer user support specialists. Most people employed in these occupations have at least a bachelor's degree. Projections indicate the industry will grow by over 23,500 new jobs between 2014 and 2024.
- **General medical and surgical hospitals** employ a diverse range of health care professionals at multiple levels of educational attainment. This includes professions from surgeons to medical secretaries, as well as a range of nursing professions such as nursing assistants, licensed practical nurses and registered nurses. Projections indicate the industry will add approximately 23,600 new jobs between 2014 and 2024.

Industry sectors that are projected to add significant numbers of new jobs to Pennsylvania over the next ten years will provide opportunities to establish stronger business collaboration and course alignment to these sectors. Furthermore, State System universities currently offer a range of degree programs in business, computer science and health that align well to opportunities within these high-growth sectors. Fig. 6 on the next page displays the ten largest growth industries projected to 2024.

Fig. 6: Pennsylvania's Top 10 Largest Growth Sectors and Projections, 2014-2024

Industry Title	2014 Jobs	2024 Jobs	New Jobs 2014-2024	% Change 2014-2024
Individual and Family Services	115,858	156,278	40,420	34.9%
Employment Services	108,361	142,374	34,013	31.4%
Restaurants and Other Eating Places	334,874	368,731	33,857	10.1%
General Medical and Surgical Hospitals	248,181	271,788	23,607	9.5%
Computer Systems Design and Related Services	64,834	88,371	23,537	36.3%
Home Health Care Services	46,405	69,757	23,352	50.3%
Management of Companies and Enterprises	132,758	151,533	18,775	14.1%
Continuing Care Retirement Communities and Assisted Living Facilities for the Elderly	67,910	83,119	15,209	22.4%
Warehousing and Storage	64,980	78,552	13,572	20.9%
Offices of Other Health Practitioners	42,072	55,213	13,141	31.2%
Total, Ten Largest Growth	1,226,233	1,465,716	239,483	19.5%

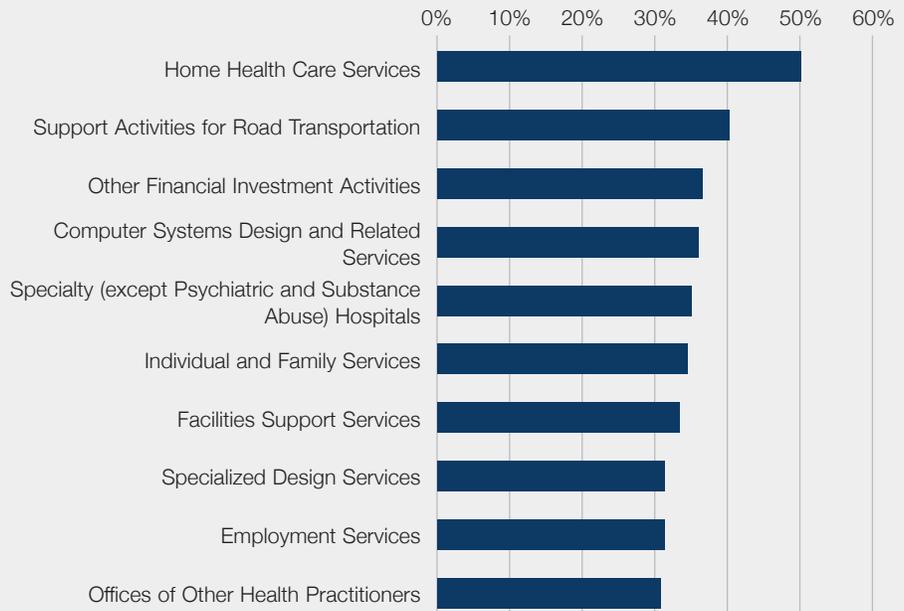
Source: BLS (QCEW); Pennsylvania Department of Labor & Industry; Oxford Economics Projections

2.4 Fastest Growing 4-Digit Industries

The fastest growing 4-digit industries are identified by the highest relative change (percent change) projected to occur between 2014 and 2024. The fastest growing industries represent emerging sectors within Pennsylvania that may present opportunities for collaboration and support from post-secondary education and training institutions. Given the aging population in the U.S. and Pennsylvania, the health care sector is driving demand for workers. The fastest growing industries in Pennsylvania include home health care services, support activities for road transportation, and other financial investment activities.

Fig. 7 depicts the 10 fastest growing industries and the projected growth from 2014 to 2024 and Fig. 8 displays the employment in Pennsylvania's 10 fastest growing industries, projected job growth, and 10-year new and replacement jobs.

Fig. 7: Pennsylvania’s Fastest Growing 4-Digit Industries and Projections, 2014-2024



Source: BLS (QCEW); Pennsylvania Department of Labor & Industry; Oxford Economics Projections

Fig. 8: Pennsylvania’s Fastest Growing 4-Digit Industries and Projections, 2014-2024

Industry Title	2014 Jobs	2024 Jobs	New Jobs 2014-2024	% Change 2014-2024
Home Health Care Services	46,405	69,757	23,352	50.3%
Support Activities for Road Transportation	5,138	7,225	2,087	40.6%
Other Financial Investment Activities	30,009	41,151	11,142	37.1%
Computer Systems Design and Related Services	64,834	88,371	23,537	36.3%
Specialty (except Psychiatric and Substance Abuse) Hospitals	25,123	33,972	8,849	35.2%
Individual and Family Services	115,858	156,278	40,420	34.9%
Facilities Support Services	7,107	9,497	2,390	33.6%
Specialized Design Services	4,596	6,041	1,445	31.4%
Employment Services	108,361	142,374	34,013	31.4%
Offices of Other Health Practitioners	42,072	55,213	13,141	31.2%
Total, 10 Fastest Growing	449,503	609,879	160,376	35.7%

Source: BLS (QCEW); Pennsylvania Department of Labor & Industry; Oxford Economics Projections

2.5 Industry Concentration

Certain Pennsylvania industries have a greater concentration in Pennsylvania as compared to the nation. A location quotient (LQ) for an industry provides perspective on statewide concentration in industry classifications. When evaluated jointly with the industry employment data, one gains a sense of the industry sectors that might benefit from efforts to align educational opportunities with economic development (i.e. industries that State System universities may consider engaging in larger conversations about aligning employer and educational needs).

Location quotients equal to 1 indicate that the area's industry concentration is equal to the national concentration of the same industry. Industries with higher location quotients (usually greater than 1.2) indicate that a region has a concentration in the production of that good or service, relative to the rest of the nation. A value of 1.5 indicates that industry employment within the region is 1.5 times more concentrated than the U.S. average. A location quotient below 1 indicates that industry employment within the region is less concentrated compared to the U.S. average. Note: High employment industries do not necessarily result in large location quotients, as this is a relative statistic.

The location quotient chart provides three key pieces of information. The vertical axis indicates the location quotient value. The horizontal axis indicates whether the industry sector is projected to grow or decline over the next 10 years. The size of the bubble indicates the size of employment in the industry.

Industries with high LQ's that are adding new jobs suggest that the comparative regional advantage may be creating further job growth. When viewed together, large employment industries (large bubbles) that have high concentrations (high LQs) and add new jobs (high growth), are significant driving forces for regional growth and advancement.

Industry sectors that are highly concentrated in Pennsylvania, show job growth, and have high levels of employment include: railroad rolling stock manufacturing; sugar and confectionary product manufacturing; school and employee bus transportation; specialty hospitals; and forging and stamping.

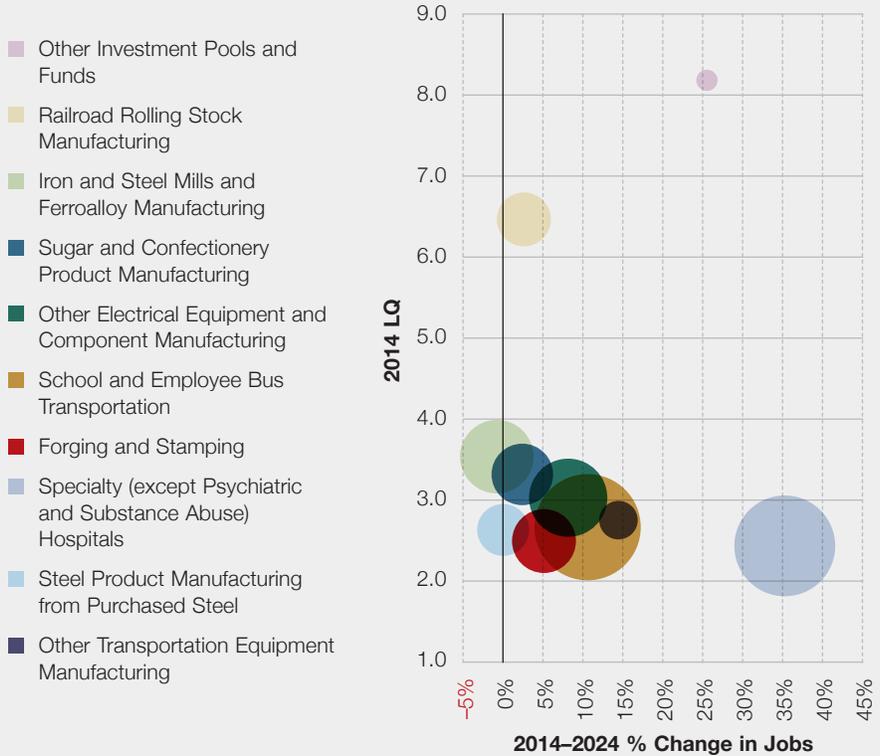
Fig. 9 displays the top 10 most concentrated industries (as measured by LQ) for Pennsylvania at the 4-digit NAICS level in 2014.

How to read a Location Quotient chart

The location quotient (LQ) bubble chart provides three key sources of information: level of concentration, as indicated by the LQ value, the % change in the variable measured—industries and occupations in this report—and the number of jobs employed. The LQ value is located on the vertical chart. As described above, values above the 1 on the vertical axis indicate higher levels of concentration compared to the national average. Bubbles situated above zero on the horizontal axis indicate positive job growth. Finally, larger bubbles indicate that the employment within the measured indicate larger levels of employment.

If one were to divide the bubble chart into sections, bubbles with LQ's greater than 1 located in the upper right hand section indicate highly concentrated industries that are projected to grow, whereas bubbles with LQ's greater than 1 in the left side indicate highly concentrated industries that are projected to decline. Similarly, LQ's less than one but on the right side, indicate job growth, but with a low concentration of employment, relative to the US average. Finally, LQ's less than one and on the left side indicate a low level of employment concentration with projected job loss.

Fig. 9: Pennsylvania’s Top 10 Most Concentrated 4-Digit Industries and Projected Growth, 2014-2024



Source: BLS (QCEW); Pennsylvania Department of Labor & Industry; Oxford Economics Projections

Fig. 10: Pennsylvania’s Top 10 Most Concentrated 4-Digit Industries and Projected Growth, 2014-2024

NAICS Code	Industry Title	2014 Jobs	2014 LQ	% Change 2014-2024
5259	Other Investment Pools and Funds	1,195	8.2	25.5%
3365	Railroad Rolling Stock Manufacturing	7,312	6.5	2.8%
3311	Iron and Steel Mills and Ferroalloy Manufacturing	13,428	3.6	-0.6%
3113	Sugar and Confectionery Product Manufacturing	9,580	3.3	2.7%
3359	Other Electrical Equipment and Component Manufacturing	15,892	3.0	8.3%
3369	Other Transportation Equipment Manufacturing	3,695	2.8	14.5%
4854	School and Employee Bus Transportation	27,367	2.7	10.6%
3312	Steel Product Manufacturing from Purchased Steel	6,528	2.6	0.3%
3321	Forging and Stamping	10,359	2.5	5.2%
6223	Specialty (except Psychiatric and Substance Abuse) Hospitals	25,123	2.5	35.2%

Source: BLS (QCEW); Pennsylvania Department of Labor & Industry; Oxford Economics Projections

The figure reflects the comparative advantage Pennsylvania enjoys in various manufacturing sectors (both advanced and non-advanced) and shows the strong and diverse manufacturing base in the commonwealth. Finance and insurance sectors, specifically other investment pools and funds also show high levels of concentration highlighting the state's large financial sector.

The next section provides information on occupational employment and describes the types of jobs people hold in Pennsylvania.

3. OCCUPATIONAL PROFILE OF PENNSYLVANIA

Examining occupational employment data reveals the importance of skills, experience and knowledge of workers. It showcases the types of jobs in which Pennsylvania's workforce is currently employed and projected to be employed by 2024. When evaluating occupation employment and demand, it is important to note that an occupation can be found in many different industry sectors. For example, every major industry sector employs accountants and auditors to maintain books, payroll, and ensure reporting compliance. This analysis compiles occupational employment across all industry sectors and reports the total number of jobs, median annual wages, and demand (10-year new and replacement jobs) for each occupation classification. The analysis also considers the educational attainment level that is typically required to gain employment in an occupation.

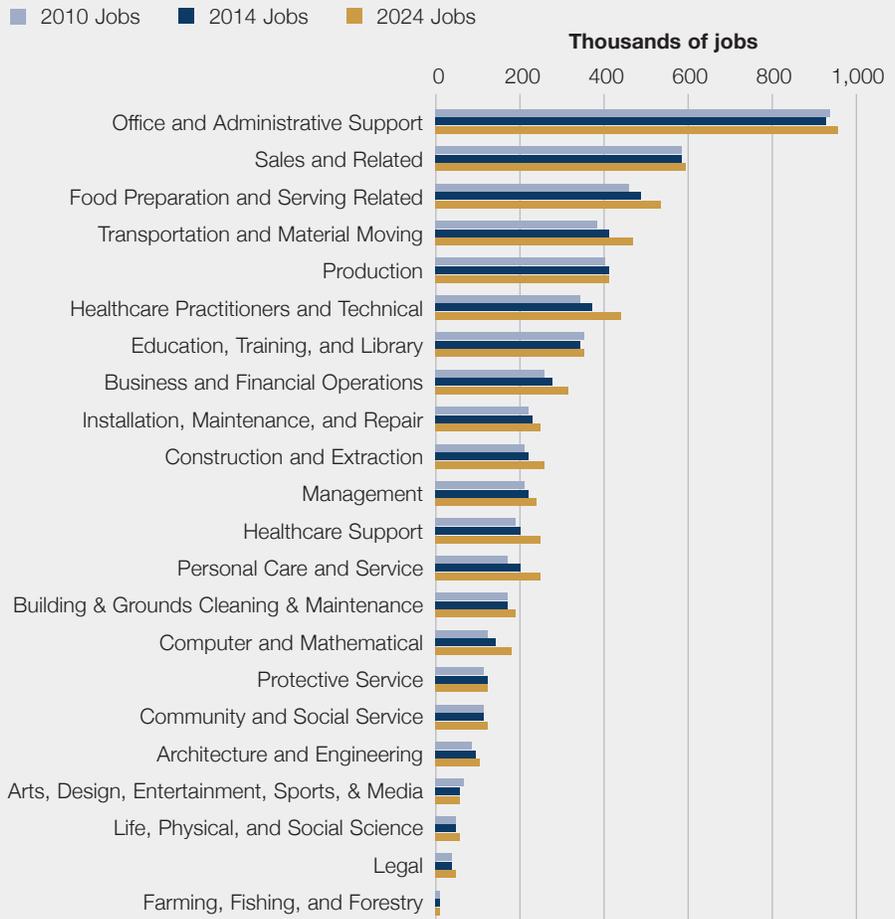
The state's workforce changes and labor demand are presented in multiple ways in this section including:

- Major occupation groups (2-digit SOC),
- Skilled occupations,
- Largest detailed occupations (6-digit SOC) in 2014,
- Occupations (6-digit SOC) with high location quotient (or concentration) in 2014, and
- Occupations aligning to educational attainment at the associate's degree level as well as the bachelor's and graduate degree level, specifically:
 - Top high demand occupations (6-digit SOC) from 2014 to 2024,
 - Fastest growing occupations (6-digit SOC) from 2014 to 2024.

The following sub-section begins the analysis by examining major occupation groups in Pennsylvania in 2014 and projected growth to 2024.

3.1 Major Occupation Groups

Fig. 11: Pennsylvania’s Projected Changes in Major Occupation Categories, 2010, 2014, and 2024



Source: BLS (QCEW and OES); Pennsylvania Department of Labor & Industry; Oxford Economics Projections

In Pennsylvania, several occupation categories are projected grow over the next 10 years, from 2014 to 2024, as well as require a significant level of replacement labor.¹⁸ Certain major occupation categories—at the 2-digit Standard Occupation Classification (SOC) level—have experienced substantial growth in recent years and are expected to continue to lead the pack to 2024. Between 2010 and 2014 Pennsylvania experienced growth in several

¹⁸ This estimate accounts for the need to replace workers who leave an occupation permanently due to retirement, death, or a change in occupation.

Identifying Skilled Occupations

For this analysis a “skilled” occupation is defined as an occupation in O*NET Job Zones* Three, Four or Five. The O*NET program is the nation’s primary source of occupational information. Central to the project is the O*NET database, containing information on hundreds of standardized and occupation-specific descriptors. The database, which is available to the public at no cost, is continually updated by surveying a broad range of workers from each occupation.** Most occupations in Job Zone Three require training in vocational schools, related on-the-job experience, or an associate’s degree. Most occupations in Job Zone Four require a four-year bachelor’s degree, but some do not. Most occupations in Job Zone Five require graduate school. For example, they may require a master’s degree, and some require a Ph.D., M.D., or J.D. (law degree).

For a more detailed description of O*NET Job Zones and training requirements see Appendix B.

occupation categories, which are typically aligned with post-secondary education. These include:

- Healthcare practitioners and technical occupations (22,400 new jobs),
- Business and financial occupations (17,600 new jobs),
- Computer and mathematical occupations (16,400 new jobs), and
- Healthcare support occupations (7,900 new jobs).

These four categories account for over one third of the total projected occupation job growth in Pennsylvania from 2014 to 2024.

3.2 Skilled Occupations Overview

The Pennsylvania economy had 5.6 million jobs in 2014, a number which is projected to grow to 6.2 million in 2024 – an increase of about 536,200 jobs or a 9.5 percent change. It is important to note that the share of Pennsylvania jobs that will require some post-secondary education will increase from 2014 to 2024, showing the employer demand for skilled workers will continue to grow.

The growth in jobs that require some level of post-secondary education in 2024 is projected to be 10.9 percent as compared to 8.1 percent for those that do not require post-secondary education. Of the 6.2 million jobs the commonwealth is projected to have in 2024, 50 percent require some amount of post-secondary education preparation. These are defined as skilled jobs or skilled occupations in the State System’s Gap Analysis project using terminology from the O*NET program.

Fig. 12 shows the number of jobs in Pennsylvania by skilled occupations (Job Zones 3-5) and low skilled occupations (Job Zones 1-2) in 2014 as well as projected growth to 2024 for each set of occupations.

Fig. 12: Pennsylvania Projected Job Growth by Job Zone, 2014-2024

	2014	2024	% Change 2014-2024	Share 2014	Share 2024
Pennsylvania, Total Jobs	5,643,677	6,179,890	9.5%	100%	100%
Job Zones 1-2 (Low Skilled)	2,866,959	3,099,406	8.1%	51%	50%
Job Zones 3-5 (Skilled)	2,776,718	3,080,484	10.9%	49%	50%

Source: BLS (QCEW); Pennsylvania Department of Labor & Industry, O*NET; Oxford Economics Projections

* <https://www.onetonline.org/help/online/zones>
 ** <http://www.onetcenter.org/overview.html>

3.3 Largest Occupations

Top occupations in the state are driven by industry composition. Medical centers employ a cadre of health professionals, while enterprise management companies employ a range of business professionals. Given the dominating presence of health care and social assistance, accommodation and food services, retail trade and manufacturing establishments in Pennsylvania, top occupations include: retail salespersons, cashiers, food preparation and serving workers, registered nurses, and office clerks. Fig. 13 highlights the top 15 occupations in the state, 10-year job growth projections, and new and replacement jobs¹⁹. The Job Zone is also included to indicate skill level for each occupation.²⁰

Fig. 13: Largest Occupations in Pennsylvania and Projected Growth, 2014-2024

Occupation Title	Job Zone	2014	2024	% Change 2014-2024	New and Replacement Jobs
Retail Salespersons	2	195,146	206,101	5.6%	81,800
Cashiers	1	147,814	140,880	-4.7%	62,577
Combined Food Preparation and Serving Workers, Including Fast Food	1	134,139	154,195	15.0%	77,679
Registered Nurses	3	128,807	154,599	20.0%	51,874
Office Clerks, General	2	127,579	124,901	-2.1%	26,701
Laborers and Freight, Stock, and Material Movers, Hand	2	115,791	140,560	21.4%	66,493
Customer Service Representatives	2	107,460	119,666	11.4%	44,675
Secretaries and Administrative Assistants, Except Legal, Medical, and Executive	3	107,410	121,313	12.9%	27,860
Waiters and Waitresses	1	97,283	109,443	12.5%	63,644
Janitors and Cleaners, Except Maids and Housekeeping Cleaners	2	88,429	92,434	4.5%	24,283
Stock Clerks and Order Fillers	2	79,527	79,743	0.3%	28,001
Nursing Assistants	2	75,720	88,822	17.3%	28,393
Heavy and Tractor-Trailer Truck Drivers	2	72,622	87,398	20.3%	30,063
General and Operations Managers	4	65,499	76,216	16.4%	22,377
Bookkeeping, Accounting, and Auditing Clerks	3	65,090	70,698	8.6%	12,044

Source: BLS (QCEW and OES); Pennsylvania Department of Labor & Industry; Oxford Economics Projections

19 New and replacement job change takes into account demand for occupations based on: industry growth (new jobs), occupation productivity, workforce ageing (retirements and deaths), migration and other factors that would contribute to new and replacement job openings.

20 Job Zone One and Two represent low-skilled occupations and Job Zone Three, Four and Five represent skilled occupations.

3.4 Occupation Concentration

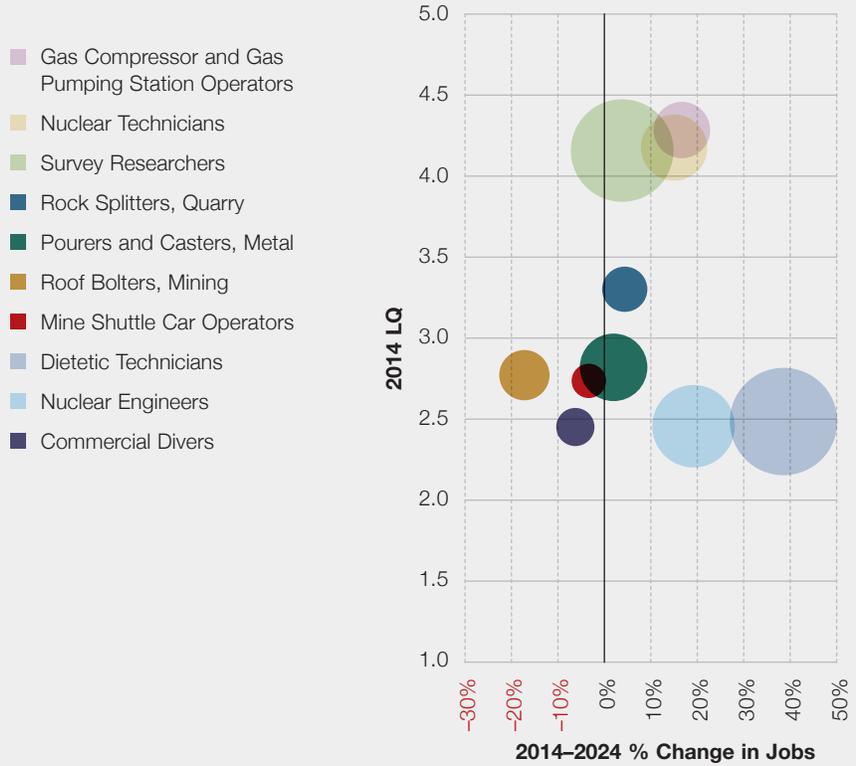
Growth in areas of comparative advantage provides career opportunities that reflect statewide workforce concentration. Just as industry location quotient analysis is used to determine industry concentration, occupation location quotient analysis is used to evaluate specializations that exist within Pennsylvania's workforce, which may indicate the presence of key occupation clusters. A classic example of one such cluster would be Silicon Valley's large concentration of IT and computer programming occupations. The presence of occupation concentration (especially skilled occupations) indicates areas of opportunity for post-secondary institutions to support workforce needs for occupations that have strong employment advantages within the Commonwealth.

Location quotients equal to 1 indicate that the area's occupation concentration is equal to the national concentration of the same occupation. Occupations with higher location quotients (usually greater than 1.2) indicate that a region has a concentration or comparative advantage in the occupation, relative to the rest of the nation. A value of 1.5 indicates that occupation employment within the region is 1.5 times more concentrated compared to the U.S. average. A location quotient below 1 indicates that occupation employment within the region is less concentrated compared to the U.S. average. Note: High employment occupations do not necessarily result in large location quotients, as this is a comparative statistic.

The location quotient chart provides three key pieces of information. The vertical axis indicates the location quotient value. A value of 1.5 indicates that employment within the region is 1.5 times more concentrated compared to the average region in the U.S. The horizontal axis indicates whether the occupation is projected to grow or decline over the next 10 years. Occupations with high LQ's that are adding new jobs suggest that the comparative regional advantage may be creating further employment opportunities. The size of the bubble indicates the number of jobs within the occupations. When viewed together skilled occupations with large employment (large bubbles) that have comparative advantages (high LQs) and are adding new jobs (high growth), are likely critical areas of regional workforce needs and warrant closer evaluation of program availability and completion to support statewide workforce demand.

In Pennsylvania, survey researchers, mental health counselors, mental health and substance abuse social workers and dietetic technicians indicate strong occupation growth, high concentration and high skills that align to post-secondary education and training. Fig. 14 illustrates the LQ, projected job change and employment size of the top 10 most concentrated occupations

Fig. 14: Pennsylvania's Top 10 Most Concentrated Occupations and Projected Growth, 2014-2024



Source: BLS (QCEW); Pennsylvania Department of Labor & Industry; Oxford Economics Projections

Fig. 15: Pennsylvania's Top 10 Most Concentrated Occupations and Projected Growth, 2014-2024

Occupation Title	LQ	2014 Jobs	2024 Jobs	% Change 2014-2024
Gas Compressor & Gas Pumping Station Operators	4.28	840	979	16.5%
Nuclear Technicians	4.18	1,113	1,280	15.0%
Survey Researchers	4.16	2,677	2,778	3.8%
Rock Splitters, Quarry	3.30	500	522	4.4%
Pourers and Casters, Metal	2.82	1,141	1,164	2.0%
Roof Bolters, Mining	2.77	660	548	-17.0%
Mine Shuttle Car Operators	2.73	300	290	-3.3%
Dietetic Technicians	2.48	2,971	4,114	38.5%
Nuclear Engineers	2.45	1,693	2,017	19.1%
Commercial Divers	2.45	370	347	-6.2%

Source: BLS (QCEW and OES); Pennsylvania Department of Labor & Industry; Oxford Economics Projections

(as measured by LQ) in Pennsylvania in 2014. Fig. 15 below provide detailed data on the occupations, including LQ, 2014 jobs, projected 2024 jobs and projected percent change in jobs.

3.5 Occupations Aligning to Associate's Degrees

Pennsylvania employment projections to 2024 conducted by the State System's Gap Analysis project indicate significant growth in many occupations that align with post-secondary education. Occupations that generally align to associate's degree programs are categorized as Job Zone Three.

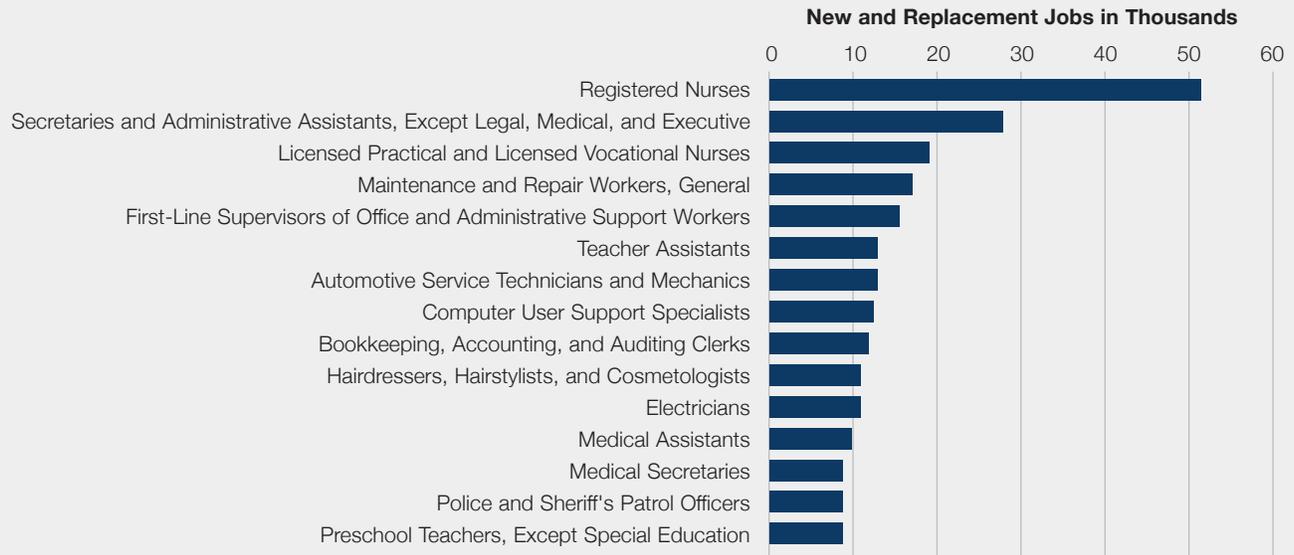
There are over 200 Job Zone Three occupations. Looking ahead, many Job Zone Three occupations show significant growth and demand. Projections indicate 11.3% growth in Job Zone Three jobs between 2014 and 2024. Job demand is further emphasized through both new job growth and replacement job openings as workers in the profession retire, relocate, or change jobs. Projections for new and replacement jobs between 2014 and 2024 exceed 487,200 for Job Zone Three occupations.

3.5.1 Top High Demand Occupations Aligning to Associate's Degrees

Top high demand occupations in the state are largely driven by the sheer size of the employment within the occupation and often times reflect the largest occupations in the state. However, career changes and the demographic characteristics of those who are currently employed—specifically age—also influence replacement demand. Occupations that employ an older demographic, specifically those aged 55 and older, will face increasing pressure to replace workers as older workers approach retirement age.

High demand occupations are identified as having the largest projected new and replacement demand between 2014 and 2024. This section focuses on Job Zone Three occupations that typically align to associate's degrees. High demand occupations aligned to associate's degrees include: registered nurses, secretaries and administrative assistants, and maintenance and repair workers. Fig. 16 and Fig. 17 highlight Pennsylvania's top 15 high demand occupations aligning to associate's degrees, projected job growth, and 10-year new and replacement jobs.

Fig. 16: Top 15 High Demand Occupations Aligning to Associate’s Degrees, 2014-2024



Source: BLS (QCEW and OES); Pennsylvania Department of Labor & Industry; Oxford Economics Projections

Fig. 17: Employment Projections for Top 15 High Demand Occupations in Aligning to Associate’s Degrees, 2014-2024

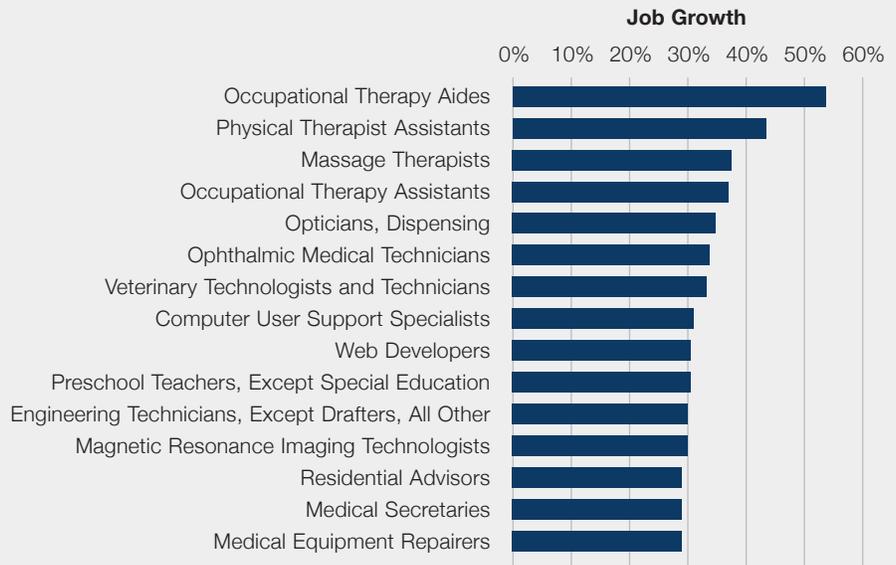
Occupation Title	2014 Jobs	2024 Jobs	% Change 2014-2024	10-year New and Replacement Jobs
Registered Nurses	128,807	154,599	20.0%	51,874
Secretaries and Administrative Assistants, Except Legal, Medical, and Executive	107,410	121,313	12.9%	27,860
Licensed Practical and Licensed Vocational Nurses	36,876	46,128	25.1%	18,990
Maintenance and Repair Workers, General	61,467	64,865	5.5%	16,938
First-Line Supervisors of Office and Administrative Support Workers	53,975	56,449	4.6%	15,400
Teacher Assistants	45,510	47,400	4.2%	13,200
Automotive Service Technicians and Mechanics	33,495	36,747	9.7%	12,992
Computer User Support Specialists	25,365	33,260	31.1%	12,436
Bookkeeping, Accounting, and Auditing Clerks	65,090	70,698	8.6%	12,044
Hairdressers, Hairstylists, and Cosmetologists	24,351	28,440	16.8%	10,977
Electricians	22,120	26,939	21.8%	10,844
Medical Assistants	23,869	28,903	21.1%	9,826
Medical Secretaries	21,680	27,973	29.0%	8,822
Police and Sheriff’s Patrol Officers	27,582	26,483	-4.0%	8,796
Preschool Teachers, Except Special Education	14,526	18,977	30.6%	8,622

Source: BLS (QCEW and OES); Pennsylvania Department of Labor & Industry; Oxford Economics Projections

3.5.2 Fastest Growing Occupations Aligning to Associate's Degrees

The fastest growing occupations are identified by the highest relative change (percent change) projected to occur between 2014 and 2024. The fastest growing occupations in the state are largely driven by industry growth and demand. Growing industries reflect the needs of the broader economy. Given the aging population in the U.S. and Pennsylvania, the health care sector is driving demand for workers. The fastest growing occupations aligning to associate's degrees include: occupational therapy aides, physical therapy assistants, massage therapists, occupational therapy assistants, and opticians (dispensing). Fig. 18 and Fig. 19 highlight Pennsylvania's 15 fastest growing occupations aligning to associate's degrees, projected job growth, and 10-year new and replacement jobs.

Fig. 18: Top 15 Fastest Growing Occupations Aligning to Associate's Degrees, 2014-2024



Source: BLS (QCEW); Pennsylvania Department of Labor & Industry; Oxford Economics Projections

Fig. 19: Employment Projections for Top 15 Fastest Growing Occupations Aligning to Associate’s Degrees, 2014-2024

Occupation Title	2014	2024	% Change 2014-2024	New and Replacement Jobs
Occupational Therapy Aides	600	923	53.8%	493
Physical Therapist Assistants	4,652	6,680	43.6%	3,285
Massage Therapists	2,291	3,160	37.9%	1,099
Occupational Therapy Assistants	2,481	3,409	37.4%	1,693
Opticians, Dispensing	3,131	4,233	35.2%	2,171
Ophthalmic Medical Technicians	1,120	1,501	34.0%	519
Veterinary Technologists and Technicians	4,212	5,624	33.5%	1,858
Computer User Support Specialists	25,365	33,260	31.1%	12,436
Web Developers	3,922	5,125	30.7%	1,842
Preschool Teachers, Except Special Education	14,526	18,977	30.6%	8,622
Engineering Technicians, Except Drafters, All Other	2,745	3,579	30.4%	1,517
Magnetic Resonance Imaging Technologists	1,361	1,772	30.2%	628
Residential Advisors	7,593	9,826	29.4%	6,043
Medical Secretaries	21,680	27,973	29.0%	8,822
Medical Equipment Repairers	2,641	3,406	29.0%	1,688

Source: BLS (QCEW and OES); Pennsylvania Department of Labor & Industry; Oxford Economics Projections

3.6 Occupations Aligning to Bachelor’s and Graduate Degrees

Job Zones Four and Five describe occupations that typically require a bachelor’s degree or graduate degree. There are over 250 Job Zone Four and Five occupation classifications. Projections indicate that many occupations typically requiring a bachelor’s degree or higher will grow 10.6% between 2014 and 2024. This growth will result in total demand for new and replacement job openings of nearly 475,900 over the same time period.

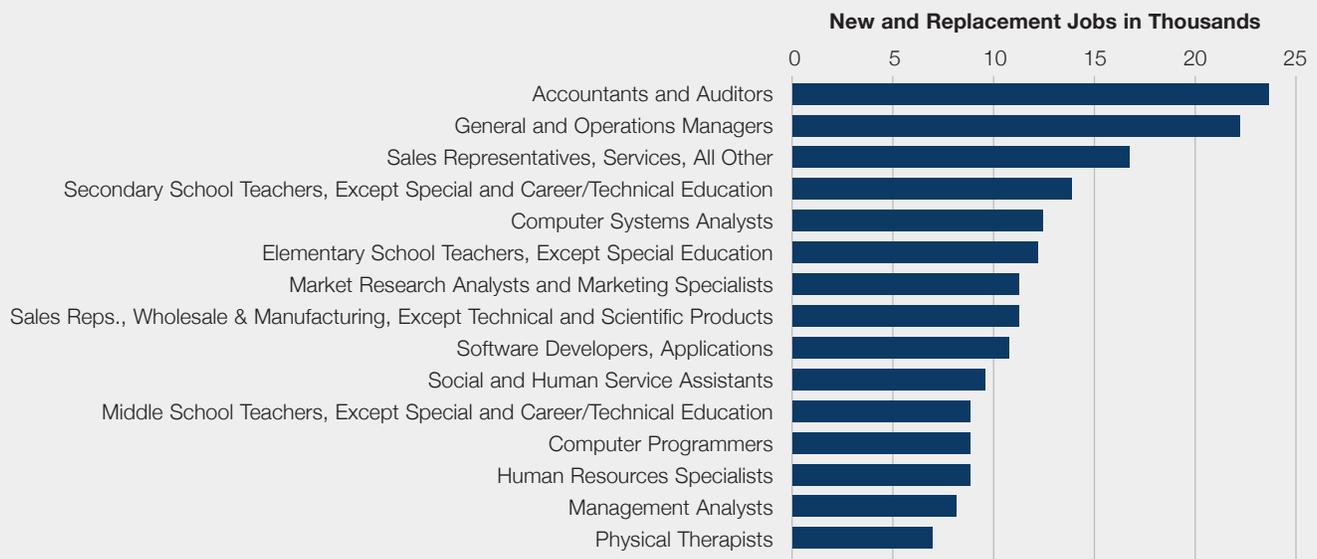
3.6.1 Top High Demand Occupations Aligning to Bachelor’s and Graduate Degrees

Top high demand occupations in the state are largely driven by industry demand for skilled workers and typically the largest occupations in the state. However, job churn and the demographic characteristics of those who are

currently employed—specifically age—also influence replacement demand. Occupations that employ an older demographic, specifically those aged 55 and older, will face increasing pressure to replace workers as older workers approach retirement age.

High demand occupations are identified as having the largest projected new and replacement demand between 2014 and 2024. This section focuses on Job Zone Four and Five occupations that typically align to bachelor’s and graduate degrees. High demand occupations aligning to bachelor’s and graduate degree level education include: accountants and auditors, general and operations managers, secondary school teachers, and sales representatives, all other. Fig. 20 and Fig. 21 highlight Pennsylvania’s top 15 high demand occupations aligning to bachelor’s and graduate degrees, projected job growth, and 10-year new and replacement jobs.

Fig. 20: Top 15 High Demand Occupations Aligning to Bachelor’s and Graduate Degrees, 2014-2024



Source: BLS (QCEW and OES); Pennsylvania Department of Labor & Industry; Oxford Economics Projections

Fig. 21: Employment Projections for Top 15 High Demand Occupations Aligning to Bachelor’s and Graduate Degrees, 2014-2024

Occupation Title	2014 Jobs	2024 Jobs	% Change 2014-2024	New and Replacement Jobs
Accountants and Auditors	54,384	59,962	10.3%	23,682
General and Operations Managers	65,499	76,216	16.4%	22,377
Sales Representatives, Services, All Other	30,180	38,249	26.7%	16,728
Secondary School Teachers, Except Special and Career/Technical Education	50,953	47,611	-6.6%	14,012
Computer Systems Analysts	23,193	31,622	36.3%	12,531
Elementary School Teachers, Except Special Education	55,324	53,736	-2.9%	12,330
Market Research Analysts and Marketing Specialists	23,315	30,907	32.6%	11,326
Sales Representatives, Wholesale and Manufacturing, Except Technical and Scientific Products	63,944	60,271	-5.7%	11,182
Software Developers, Applications	21,322	28,985	35.9%	10,702
Social and Human Service Assistants	22,576	25,478	12.9%	9,638
Middle School Teachers, Except Special and Career/Technical Education	24,071	26,935	11.9%	8,910
Computer Programmers	14,318	18,478	29.1%	8,849
Human Resources Specialists	19,642	24,278	23.6%	8,830
Management Analysts	21,463	26,143	21.8%	8,251
Physical Therapists	10,685	14,539	36.1%	6,878

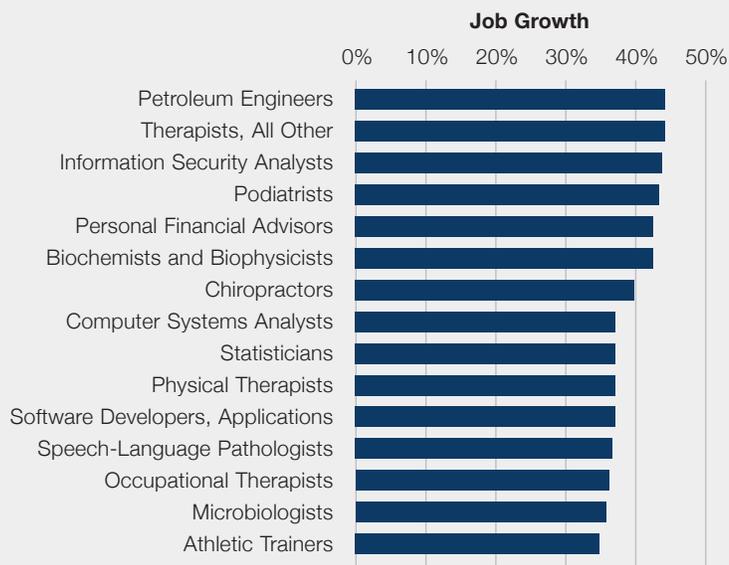
Source: BLS (QCEW and OES); Pennsylvania Department of Labor & Industry; Oxford Economics Projections

3.6.2 Fastest Growing Occupations Aligning to Bachelor’s and Graduate Degrees

The fastest growing occupations are identified by the highest relative change (percent change) projected to occur between 2014 and 2024. The fastest growing occupations aligning to bachelor’s and graduate degrees include: petroleum engineers, therapists, information security analysts, podiatrists, and personal financial advisors. Fig. 22 and Fig. 23 highlight Pennsylvania’s 15 fastest growing occupations aligning to bachelor’s and graduate degrees, projected job growth, and 10-year new and replacement jobs.

The next section provides a high-level overview of Pennsylvania’s education program output by broad degree category.

Fig. 22: Top 15 Fastest Growing Occupations Aligning to Bachelor's and Graduate Degrees, 2014-2024



Source: BLS (QCEW and OES); Pennsylvania Department of Labor & Industry; Oxford Economics Projections

Fig. 23: Employment Projections for Top 15 Fastest Growing Occupations Aligning to Bachelor's and Graduate Degrees, 2014-2024

SOC Code	Occupation Title	2014	2024	% Change 2014-2024	New and Replacement Jobs
17-2171	Petroleum Engineers	831	1,189	43.1%	655
29-1129	Therapists, All Other	390	558	43.1%	212
15-1122	Information Security Analysts	2,451	3,490	42.4%	1,417
29-1081	Podiatrists	510	724	42.0%	420
13-2052	Personal Financial Advisors	8,095	11,458	41.5%	4,871
19-1021	Biochemists and Biophysicists	1,755	2,477	41.1%	1,257
29-1011	Chiropractors	1,321	1,834	38.8%	809
15-1121	Computer Systems Analysts	23,193	31,622	36.3%	12,531
15-2041	Statisticians	1,991	2,712	36.2%	1,408
29-1123	Physical Therapists	10,685	14,539	36.1%	6,878
15-1132	Software Developers, Applications	21,322	28,985	35.9%	10,702
29-1127	Speech-Language Pathologists	4,782	6,486	35.6%	2,411
29-1122	Occupational Therapists	6,283	8,498	35.3%	3,201
19-1022	Microbiologists	1,093	1,475	34.9%	747
29-9091	Athletic Trainers	1,291	1,729	33.9%	818

Source: BLS (QCEW and OES); Pennsylvania Department of Labor & Industry; Oxford Economics Projections

4. POST-SECONDARY PROGRAM COMPLETIONS IN PENNSYLVANIA

Pennsylvania is home to many different post-secondary institutions, offering a range of degree programs. As reported by the National Center for Education Statistics (NCES), there are approximately 400 higher education institutions in the Commonwealth.²¹ These institutions have over 800,000 enrolled students and graduated on average 166,000 students from 2011 to 2013 with an associate's degree or higher.²² The top major fields of study include Business, management, marketing, and related support services, Health professions and related programs, Education, Social sciences, and Visual and performing arts.

Pennsylvania's State System of Higher Education is a large contributor to the total number of degree completions. The State System produces approximately 21% of the total bachelor's degrees and above in the state.²³ Furthermore, the State System enrolls approximately 18% of Pennsylvania's four-year institutions' learners and this number has remained steady for the past several academic years.

4.1 Associate's Degree Completions

Pennsylvania is home to over 100 different institutions that offer a range of associate's degree programs.²⁴ From 2011 to 2013, these institutions in Pennsylvania awarded, on average, almost 29,300 associate's degrees. Three program areas dominate the statewide associate's degree post-secondary education landscape:

21 This number includes the location of a physical campus/structure with learner enrolment as reported to NCES. Institutions with extension campuses that report enrollment at their main campus may not be captured within this list.

22 This number is the 3-year average completions in Pennsylvania from 2011 to 2013 as reported to NCES.

23 Georgetown's Center on Education and the Workforce: Degrees of Value: College Majors and the Pennsylvania State System's Contribution to the Workforce – October 2015

24 This number includes the location of a physical campus/structure as reported to NCES. Institutions with extension campuses that report to their main campus may not be captured within this list.

- Health professions and related programs,
- Business, management, marketing, and related support services, and
- Liberal arts and sciences, general studies and humanities.

Of the nearly 29,300 average annual completions of associate's degrees, these three program areas account for 53% of completions—representing an annual average of over 15,600 degree completions.

Computer and information sciences and support services, engineering technologies and engineering-related fields, and homeland security, law enforcement, firefighting and related protective services also represent significant statewide associate's degree programs, totaling an annual average of over 5,400 degree completions.

4.1.1 State System Associate's Degree Completions

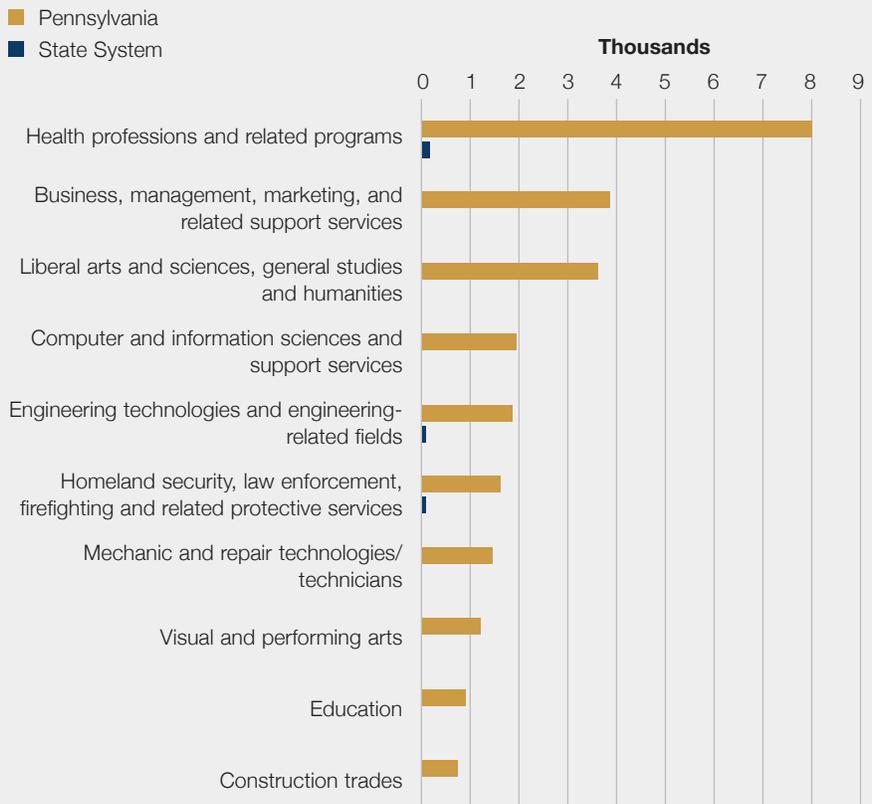
From 2011 to 2013, seven out of fourteen universities in the State System awarded associate degrees. On average, these institutions awarded 414 associate degrees annually. The top 3 schools accounted for 78% of all State System associate degree completions and include: Clarion University (161 annual average associate completions), Lock Haven University (93 annual average associate completions), and Edinboro University (68 annual average associate completions). Three program areas dominate the State System associate's degree landscape:

- Health professions and related programs,
- Engineering technologies and engineering-related fields, and
- Homeland security, law enforcement, firefighting and related protective services.

Of the 414 average annual completions of associate degrees within State System universities, these three program areas account for 68% of State System associate degree completions—representing an annual average of over 280 completions.

Fig. 24 highlights the top 10 program areas for associate's completions in Pennsylvania, along with the corresponding State System associate's completions.

Fig. 24: Program Completions for Associate’s Degrees in Pennsylvania and the State System, 2011-2013 Annual Average



Source: National Center for Education Statistics (IPEDS) 2011-2013 Completions

Fig. 25 on the next page provides the total number of associate’s degrees awarded in Pennsylvania by major field of study as well as the total number of associate’s degrees awarded by the State System.

Fig. 25: Total Program Completions for Associate's Degrees in Pennsylvania and the State System, 2011-2013 Annual Average

Major Field of Study	Pennsylvania 3-year Average Associate Completions	Share of Total Pennsylvania Associate Degrees	State System 3-year Average Associate Completions	Share of Total State System Associate Degrees
Health professions and related programs	8,091	27.6%	192	46.3%
Business, management, marketing, and related support services	3,923	13.4%	29	7.0%
Liberal arts and sciences, general studies and humanities	3,609	12.3%	29	7.0%
Computer and information sciences and support services	1,937	6.6%	3	0.8%
Engineering technologies and engineering-related fields	1,851	6.3%	50	12.1%
Homeland security, law enforcement, firefighting and related protective services	1,618	5.5%	42	10.1%
Mechanic and repair technologies/technicians	1,421	4.9%	0	0.0%
Visual and performing arts	1,178	4.0%	0	0.1%
Education	928	3.2%	35	8.5%
Construction trades	753	2.6%	0	0.0%
Personal and culinary services	637	2.2%	0	0.0%
Legal professions and studies	536	1.8%	10	2.5%
Precision production	369	1.3%	0	0.0%
Family and consumer sciences/human sciences	355	1.2%	0	0.0%
Public administration and social service professions	323	1.1%	9	2.2%
Psychology	258	0.9%	0	0.0%
Communication, journalism, and related programs	231	0.8%	0	0.0%
Social sciences	214	0.7%	0	0.0%
Communications technologies/technicians and support services	124	0.4%	0	0.0%
Multi/interdisciplinary studies	114	0.4%	0	0.0%
Transportation and materials moving	114	0.4%	0	0.0%
Physical sciences	93	0.3%	7	1.7%
Biological and biomedical sciences	85	0.3%	0	0.0%
Parks, recreation, leisure, and fitness studies	84	0.3%	0	0.0%
Engineering	80	0.3%	0	0.0%
Science technologies/technicians	76	0.3%	1	0.2%
Natural resources and conservation	67	0.2%	0	0.0%
Agriculture, agriculture operations, and related sciences	60	0.2%	0	0.0%
Mathematics and statistics	47	0.2%	0	0.0%
Theology and religious vocations	31	0.1%	0	0.0%
Architecture and related services	29	0.1%	0	0.0%
English language and literature/letters	23	0.1%	6	1.5%
Foreign languages, literatures, and linguistics	10	0.03%	0	0.0%
Area, ethnic, cultural, gender, and group studies	5	0.02%	0	0.0%
Total	29,273	100.0%	414	100.0%

Source: National Center for Education Statistics (IPEDS) 2011-2013 Completions

4.2 Bachelor's Degree Completions

Pennsylvania is home to over 150 different institutions that offer a range of bachelor's degree programs.²⁵ From 2011 to 2013, these institutions in Pennsylvania awarded, on average, nearly 90,700 bachelor's degrees. Three programs dominate bachelor's degree completions in Pennsylvania, specifically:

- Business, management, marketing, and related support services,
- Health professions and related programs, and
- Social sciences.

Of the nearly 90,700 average annual completions of bachelor's degrees, these three program areas account for nearly 37% of completions—representing an annual average of approximately 33,500 degree completions. Education, visual and performing arts, and psychology also represent significant statewide bachelor's degree programs, totaling an annual average of nearly 16,800 degree completions.

4.2.1 State System Bachelor's Degree Output

From 2011 to 2013, all fourteen universities in the State System awarded bachelor's degrees. On average, these institutions awarded just under 19,200 bachelor degrees annually. The top 3 schools accounted for 35% of all State System bachelor degree completions and include: West Chester University (2,668 annual average bachelor completions), Indiana University (2,266 annual average bachelor completions), and Kutztown University (1,803 annual average bachelor completions). The top 3 program areas for bachelor degrees in the State System include:

- Business, management, marketing, and related support services,
- Education, and
- Health professions and related programs.

Of the nearly 19,200 average annual completions of bachelor degrees within the State System, these three program areas account for 39% of bachelor degree completions—representing an annual average of nearly 7,400 completions.

²⁵ This number includes the location of a physical campus/structure as reported to NCES. Institutions with extension campuses that report to their main campus may not be captured within this list.

Fig. 26 highlights the top 10 program areas for bachelor's completions in Pennsylvania, along with the corresponding State System bachelor's completions.

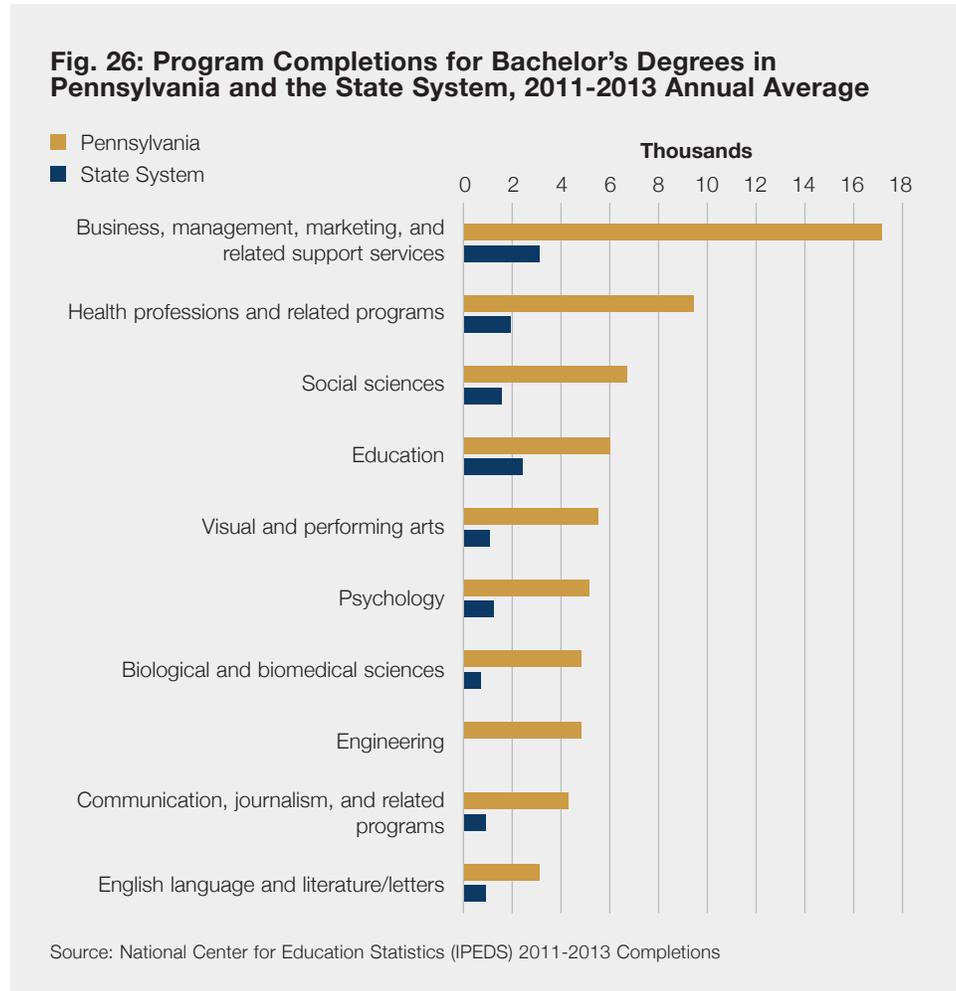


Fig. 27 on the next page provides the total number of bachelor's degrees awarded in Pennsylvania by major field of study as well as the total number of bachelor's degrees awarded by the State System.

Fig. 27: Total Program Completions for Bachelor's Degrees in Pennsylvania and the State System, 2011-2013 Annual Average

Major Field of Study	3-year Pennsylvania Average Bachelor Completions	Share of Total Pennsylvania Bachelor Degrees	State System 3-year Average Bachelor Completions	Share of Total State System Bachelor Degrees
Business, management, marketing, and related support services	17,252	19.0%	3,074	16.0%
Health professions and related programs	9,506	10.5%	1,882	9.8%
Social sciences	6,734	7.4%	1,521	7.9%
Education	5,986	6.6%	2,423	12.6%
Visual and performing arts	5,500	6.1%	1,114	5.8%
Psychology	5,268	5.8%	1,170	6.1%
Biological and biomedical sciences	4,898	5.4%	663	3.5%
Engineering	4,805	5.3%	8	0.0%
Communication, journalism, and related programs	4,366	4.8%	858	4.5%
English language and literature/letters	3,200	3.5%	930	4.8%
Computer and information sciences and support services	2,785	3.1%	352	1.8%
Homeland security, law enforcement, firefighting and related protective services	2,649	2.9%	722	3.8%
Parks, recreation, leisure, and fitness studies	2,417	2.7%	1,148	6.0%
History	1,973	2.2%	491	2.6%
Physical sciences	1,874	2.1%	434	2.3%
Liberal arts and sciences, general studies and humanities	1,361	1.5%	559	2.9%
Multi/interdisciplinary studies	1,309	1.4%	187	1.0%
Mathematics and statistics	1,236	1.4%	314	1.6%
Public administration and social service professions	1,126	1.2%	440	2.3%
Foreign languages, literatures, and linguistics	1,088	1.2%	184	1.0%
Philosophy and religious studies	884	1.0%	65	0.3%
Engineering technologies and engineering-related fields	733	0.8%	324	1.7%
Family and consumer sciences/human sciences	662	0.7%	136	0.7%
Natural resources and conservation	651	0.7%	89	0.5%
Theology and religious vocations	551	0.6%	0	0.0%
Agriculture, agriculture operations, and related sciences	498	0.5%	0	0.0%
Architecture and related services	478	0.5%	7	0.0%
Area, ethnic, cultural, gender, and group studies	315	0.3%	28	0.1%
Legal professions and studies	182	0.2%	6	0.0%
Personal and culinary services	136	0.2%	0	0.0%
Communications technologies/technicians and support services	92	0.1%	26	0.1%
Construction trades	61	0.1%	0	0.0%
Science technologies/technicians	42	0.05%	0	0.0%
Library science	30	0.03%	30	0.2%
Mechanic and repair technologies/technicians	13	0.01%	0	0.0%
Transportation and materials moving	7	0.01%	0	0.0%
Total	90,674	100.0%	19,186	100.0%

Source: National Center for Education Statistics (IPEDS) 2011-2013 Completions

4.3 Graduate Degree Completions

Pennsylvania is home to over 100 different institutions that offer a range of graduate degree programs.²⁶ From 2011 to 2013, these institutions in Pennsylvania awarded, on average, over 46,000 graduate degrees. Three programs dominate graduate degree completions in Pennsylvania, specifically:

- Education,
- Health professions and related programs, and
- Business, management, marketing, and related support services

Of the 46,245 average annual completions of graduate degrees, these three program areas account for 60% of completions—representing an annual average of approximately 27,500 degree completions. Engineering, legal professions and studies, and public administration and social service professions also represent significant statewide graduate programs, totaling an annual average of approximately 6,600 degree completions.

4.3.1 State System Graduate Degree Completions

From 2011 to 2013, all fourteen universities in the State System awarded graduate degrees. On average, these institutions awarded almost 5,700 graduate degrees annually. The top 3 schools accounted for 43% of all State System graduate degree completions and include: California University (990 annual average graduate completions), Indiana University (788 annual average graduate completions), and West Chester University (674 annual average graduate completions). The top 3 program areas for graduate degrees in the State System include:

- Education,
- Health professions and related programs, and
- Parks, recreation, leisure, and fitness studies.

Of the nearly 5,700 average annual completions of graduate degrees within the State System, these three program areas account for 61% of graduate degree completions—representing an annual average of nearly 3,500 completions.

²⁶ This number includes the location of a physical campus/structure as reported to NCES. Institutions with extension campuses that report to their main campus may not be captured within this list.

Fig. 28 highlights the top 10 program areas for graduate completions in Pennsylvania, along with the corresponding State System graduate completions.

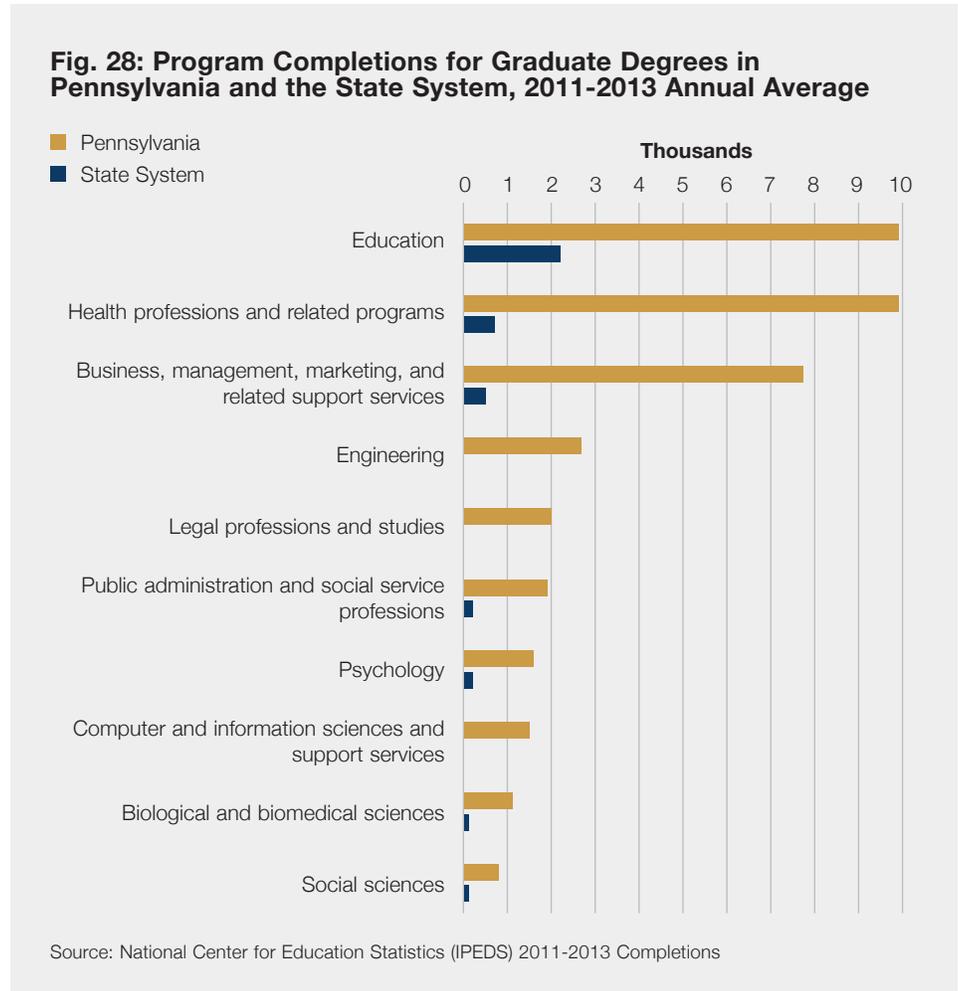


Fig. 29 on the next page provides the total number of graduate degrees awarded in Pennsylvania by major category as well as the total number of graduate degrees awarded by the State System.

The next section evaluates the combination of completions by degree type (education supply) against the demand for skilled labor by occupation to determine whether potential gaps (excess demand or supply surplus) exist within the commonwealth's post-secondary education system.

Fig. 29: Total Program Completions for Graduate Degrees in Pennsylvania and the State System, 2011-2013 Annual Average

Major Category	3-year Pennsylvania Average Graduate Completions	Share of Total Pennsylvania Graduate Degrees	State System 3-year Average Graduate Completions	Share of Total State System Graduate Degrees
Education	9,912	21.4%	2,195	38.6%
Health professions and related programs	9,865	21.3%	661	11.6%
Business, management, marketing, and related support services	7,733	16.7%	498	8.8%
Engineering	2,659	5.8%	0	0.0%
Legal professions and studies	2,015	4.4%	45	0.8%
Public administration and social service professions	1,920	4.2%	241	4.2%
Psychology	1,581	3.4%	235	4.1%
Computer and information sciences and support services	1,449	3.1%	27	0.5%
Biological and biomedical sciences	1,082	2.3%	73	1.3%
Social sciences	830	1.8%	106	1.9%
Theology and religious vocations	785	1.7%	0	0.0%
Visual and performing arts	764	1.7%	90	1.6%
Library science	761	1.6%	292	5.1%
Parks, recreation, leisure, and fitness studies	716	1.5%	618	10.9%
English language and literature/letters	636	1.4%	159	2.8%
Physical sciences	574	1.2%	17	0.3%
Architecture and related services	345	0.7%	0	0.0%
Mathematics and statistics	345	0.7%	82	1.4%
Communication, journalism, and related programs	321	0.7%	44	0.8%
Homeland security, law enforcement, firefighting and related protective services	311	0.7%	66	1.2%
Liberal arts and sciences, general studies and humanities	307	0.7%	10	0.2%
Multi/interdisciplinary studies	305	0.7%	45	0.8%
Engineering technologies and engineering-related fields	222	0.5%	65	1.2%
History	208	0.4%	61	1.1%
Foreign languages, literatures, and linguistics	178	0.4%	19	0.3%
Philosophy and religious studies	153	0.3%	10	0.2%
Natural resources and conservation	105	0.2%	13	0.2%
Agriculture, agriculture operations, and related sciences	60	0.1%	0	0.0%
Area, ethnic, cultural, gender, and group studies	59	0.1%	0	0.0%
Family and consumer sciences/human sciences	43	0.1%	8	0.1%
Total	46,245	100.0%	5,681	100.0%

Source: National Center for Education Statistics (IPEDS) 2011-2013 Completions

5. OVERVIEW OF GAP ANALYSIS

A gap analysis comparing educational supply and occupational demand serves as a critical first step in efforts to align education programs with the workforce needs of Pennsylvania employers. It provides a data-driven perspective of employer demand (growing occupations across the state) and post-secondary education supply (degree production by program and level). This section focuses on the demand gaps and supply surpluses for skilled occupations in Pennsylvania (Job Zones Three, Four and Five).

To make the connection between employer demand and education supply a crosswalk between the taxonomy of occupation codes (Standard Occupation Codes, or SOC) and major programs (Classification of Instructional Program or CIP) is required. The State System's Gap Analysis project conducted original research to enhance the traditional taxonomy of major program to occupation crosswalk using American Community Survey data that demonstrate a broader spectrum of connections between education programs and occupations.²⁷ This hybrid crosswalk connected the CIP and SOC using both the NCES and Pennsylvania standard crosswalks and the additional real-world connections using the American Community Survey.

²⁷ The existing crosswalks available include a national NCES crosswalk and a state crosswalk specific to Pennsylvania. Additional connections were made using data available in the ACS.

EDUCATION TO OCCUPATION CROSSWALKS AND WHAT SETS THIS GAP ANALYSIS APART FROM PREVIOUS STUDIES

Typical gap analysis will use one of two approaches when building a crosswalk: The Department of Education (DOE) crosswalk or the American Community Survey (ACS) crosswalk.

The DOE crosswalk, completed through collaboration with the Bureau of Labor Statistics and the National Center for Education Statistics (NCES), attempts to link occupation classifications (SOC code) to their related educational programs (CIP code). The drawback is that there is often not a one-to-one connection between education programs and occupations and in even some extreme cases, education programs related to occupations do not match the reality of careers people enter. Another drawback is that occupations often employ a range of degree and non-degree completers, which reflects the reality of the labor market. For example a customer representative for a technology company may have a bachelor's degree in computer programming, whereas a customer service representative for a retail company may only have a high school diploma.

The ACS crosswalk is built on a large survey sample consisting of 160 education program codes and 261 occupation classifications (note: these are not as detailed as CIP and SOC codes), reflecting the careers individuals take after they complete their education programs. Whereas DOE's crosswalk seeks to state what should be, the ACS crosswalk states what is. This approach is very practical when dealing with education programs that don't match closely to a specific occupation (e.g. liberal arts degrees, history degrees, etc.). Additionally, ACS data provide a measure that estimates the demand for workers with various levels of postsecondary education in a given occupation. For example if 21% of customer service representatives have a bachelor's degree, then only 21% of the annual demand for customer service representatives will be counted against the supply of matching education programs.

The methodology developed for this gap analysis bridges the two approaches above. Occupations that

are linked through DOE are not discounted, even if ACS suggests that there are relatively few degree completions entering the occupation field. Additionally, the use of ACS more closely captures the reality of where degree holders have found employment in Pennsylvania and surrounding states—note the geography for measuring gaps was restricted to Pennsylvania only, however occupation to education linkages were built on a multi-state region. While there are certainly exceptions to the rule, which were ultimately reviewed on a case-by-case basis as described in detail in Appendix E, the approach does capture the vast majority of relevant and compelling connections between education programs and occupations. Lastly, the methodology takes into account the labor market behavior of both employers and employees in the following ways:

- It provides a measure of education distribution by degree level demonstrating that a range of skill levels can exist within occupation classification.
- It captures the demand and range for bachelor's degree field of study within an occupation classification.*
- It provides a reality-driven process to connect bachelor's degree field of study to occupations, especially in the liberal arts programs.
- It provides a regionalized crosswalk that better reflects the competition for jobs in Pennsylvania and the surrounding region.

By modeling these features, this gap analysis accounts for issues that were not accounted for in previous gap analysis studies.

* The ACS reports two separate pieces of information: highest level of educational attainment for an individual and major field of study for an individual's bachelor degree. The major field of study is not reported for associate's degrees or graduate degrees.

5.1 How to use the Gap Analysis

The gap analysis results are presented as two main areas of findings: demand gaps (excess employer demand) and supply surpluses. Each outcome has a different set of implications for area stakeholders, post-secondary education institutions, and learners. These outcomes are summarized briefly below and then described further in each relevant section.

The uses of a gap analysis are many and varied and include:

- **Strategic engagement:** Increased collaboration and alignment between regional employers and education programs helps ensure a competitive, vibrant regional economy. The gap analysis enables this process by helping post-secondary institutions identify areas of employer need. The analysis provides a data-driven starting point to begin conversations with employers on how post-secondary institutions can help meet education/training needs in the regional economy.
- **Enhanced program development/evaluation:** The gap analysis serves as an additional tool for decision-making in academic program planning by addressing one aspect of the external eco-system—alignment of academic programs to the regional labor market.
- **Student engagement/career guidance:** The analysis provides information that can be used for career guidance and job search. The gap analysis results can inform learners about the alignment of education programs to careers, as well as the market demand for jobs.
- **Marketing:** By highlighting information about high demand occupations that are linked to education programs, post-secondary education institutions can demonstrate how learners will succeed after program completion. Where compelling information exists, this can be used in student recruitment efforts.

While the State System's Gap Analysis project is critical to understanding the connections between education programs and occupations, it is important to recall the caveats of this Gap Analysis report:

- When considering making adjustments to programs in degree areas related to occupations displaying gaps, further research should be considered to confirm the extent of alignment needed to arrive at equilibrium with the labor market.
- Government data that captures labor market demand lags real-time employer demand as well as higher education industry trends. As such, the gap analysis findings may lag these market changes.

- This analysis only focuses on program output as a supply pool (i.e. new graduates). However, regional workforces comprise additional pools of supply—specifically: employed workers, skilled unemployed workers, and skilled underemployed workers. When evaluating gaps, this analysis focuses on new and replacement demand, as opposed to job churn.²⁸ This helps to mitigate some of the issues involving the employed workforce.

Excess Employer Demand (Demand Gap)

A demand gap exists where the regional supply of talent is insufficient to support the workforce needs of businesses located there. Where such gaps exist businesses will likely seek talent from outside the area, which can become costly from an HR perspective. This especially affects small and medium sized businesses that usually do not have well developed HR functions. Additionally, employers—especially those in more rural areas—may face higher costs as they attempt to draw in workers from more populated areas.

ABSOLUTE DEMAND GAP VS. RELATIVE DEMAND GAP

Results for demand gaps in this analysis are calculated in two different ways. An absolute demand gap is a nominal comparison, wherein the supply of program completions which align to an occupation is subtracted from the demand for those aligned occupations. This produces a “headcount” of the additional number of program completions needed to meet the demand within an occupation.

A relative demand gap is a ratio of program supply to occupation demand, which is expressed as a percentage. A percentage below 100% indicates excess employer demand relatively (e.g. the number of program completers is less than the occupation demand), whereas a value over 100% indicates that there are more program completions relative to occupation demand.

This analysis factors in both the absolute measure and relative measure to enable a broader perspective for interpretation. For example, an occupation that may indicate an average annual demand for 40 jobs per year with 30 annual completers would require 25% more completions to bridge the gap ($30 / 40 = 0.75$). However, this absolute gap would suggest that the increased amount of program output—10 additional completers—is relatively small. Therefore for program planning purposes, both perspectives are helpful to set the context of the demand gap.

²⁸ Replacement jobs include retirements, deaths, and other workers who permanently leave an occupation. Job churn occurs when a worker leaves one job for another, but continues working in the same occupation.

This creates an opportunity to expand output or develop programs. For education institutions, gaps present an opportunity for program expansion (where current programs align, but are not creating enough output). The strategy for increasing output may differ—whether capacity or learner recruitment is a constraining factors. If a program does not exist, a gap may present an opportunity for new program development.

Leaners may gain a competitive employment edge when excess employer demand exists. For learners, when demand exceeds supply, graduates in relevant disciplines usually benefit—providing opportunities for career progression, and higher earnings in both the short- and long-term.

Supply Surplus (Supply Gap)

A supply surplus for an occupation exists when the number of program completions within a region exceeds the employer demand. This presents some key implications to consider.

ABSOLUTE SUPPLY SURPLUS VS. RELATIVE SUPPLY SURPLUS

Results for supply surpluses are calculated in two different ways. An absolute supply surplus is a nominal comparison, wherein the supply of program completions which align to an occupation is subtracted from the demand for those aligned occupations. This produces a “headcount” of the number of program completions that exceed the projected demand for a given occupation.

A relative supply surplus is a ratio of program supply to occupation demand, which is expressed as a percentage. A percent above 100% indicates a relative supply surplus (e.g. the number of program completers is more than the occupation demand).

This analysis factors both ways to enable a broader perspective for interpretation. For example, an occupation that may indicate an average annual demand for 40 jobs per year with 50 annual completers would suggest that there are about 25% more completions than the workforce demands for occupations that tie to that program ($50 / 40 = 1.25$). However, this absolute gap would suggest that the increased amount of program output—10 additional completers—is relatively small. Furthermore, this may indeed fall within “tolerable levels” of program supply surplus. Therefore for programming planning and evaluation purposes, both perspectives are helpful to set the context of the supply surplus.

If employer demand is less than education production in relevant occupations, learners are likely to leave the region after graduation causing learner attrition and outmigration. Surpluses in talent supply can also suppress wages for graduates in certain careers. Classic labor market economic theory suggests that increased competition for jobs will put downward pressure on wages—i.e. the more people competing for the same job gives an employer a better bargaining position for wage/salary. While a college degree in and of itself has a measured wage premium, specific programs areas may have a range of wage premiums based on the supply of new talent competing for jobs and the conditions of the labor market.

5.2 Excess Demand Gaps for Skilled Occupations

Excess demand gaps exist for many skilled occupations (occupations in Job Zones Three, Four and Five) within Pennsylvania. The degree programs that align to these occupations span associate's degrees through graduate degrees. Recall that a demand gap exists where the regional supply of talent is insufficient to support the workforce needs of businesses located there. The top excess demand gaps are identified by the size of the annual gap.

Of the top ten excess demand gaps, four of the occupations align to the key skilled high demand occupations evaluated in Pennsylvania's Workforce Characteristics Report. These key skilled high demand occupations are: registered nurses, accountants and auditors, computer systems analysts and market research analysts & marketing specialists. Examples of specific excess demand gaps include:

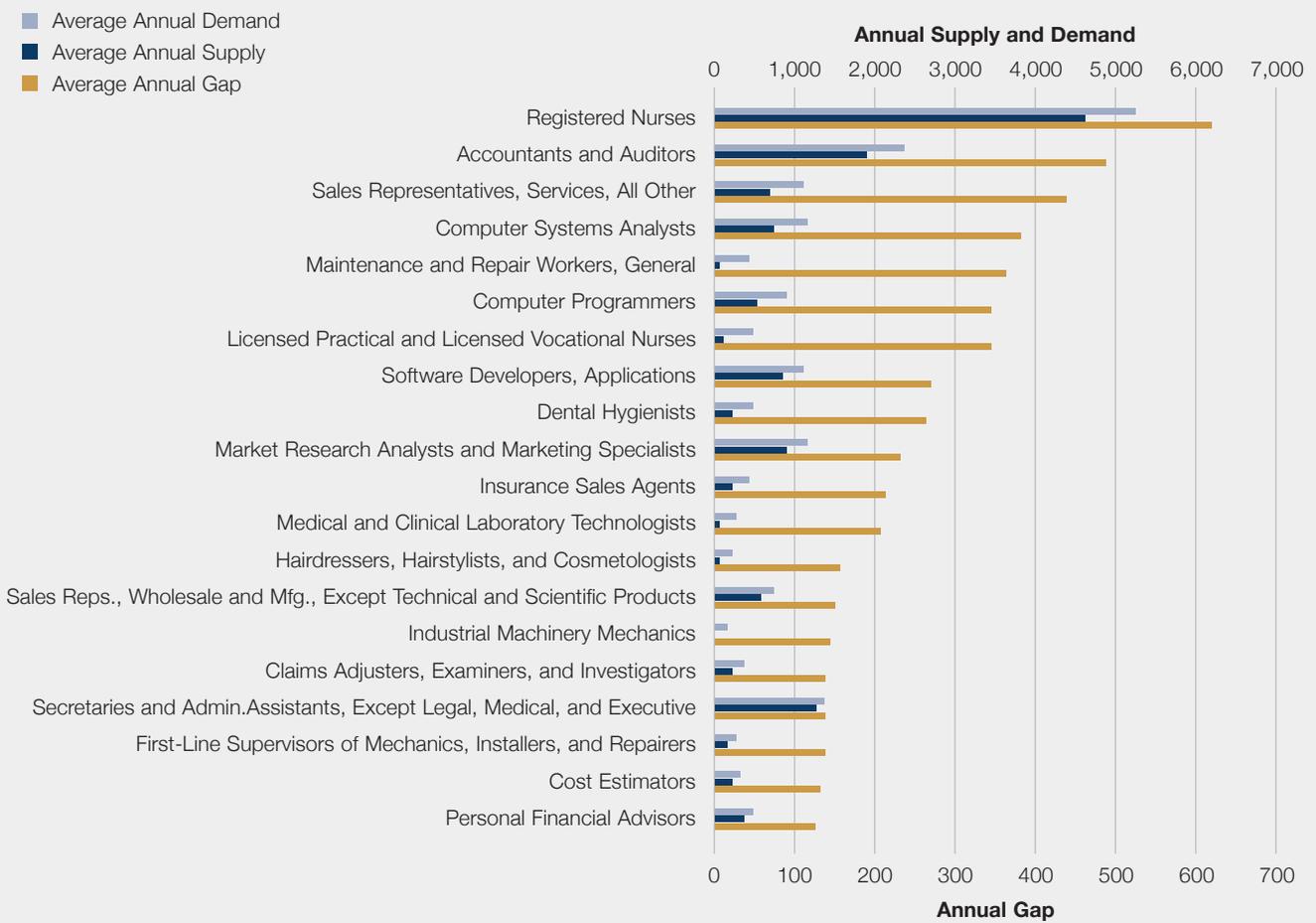
- **Registered nurses**—this occupation shows an annual demand for over 5,200 new and replacement jobs. However, the number of relevant associates and bachelor degree completions allocated to the occupation amount to 4,587.²⁹ This indicates an opportunity for exploration of expanding registered nursing programs (especially at the bachelor's level) in order to narrow the annual gap.
- **Accountants and auditors**—this occupation shows a projected annual demand of 2,350, while the program supply allocated to meet that demand is just over 1,800, revealing a demand gap of about 494. As

²⁹ Note: the number of 1-year certificate or diplomas in license practical nursing (LPN) is not counted in supply as this is below the associate's level. The number of 1-year diploma completions is significantly greater than the number of total openings for LPNs. However, 20% of employed LPNs have an associate's degree or greater. This may indicate that demand by employers includes people with associate's degrees or higher.

demonstrated in the Workforce Characteristics Report, nearly 90% of accountants and auditors in Pennsylvania have a bachelor’s degree or graduate degree. Given the high level of education attainment for the occupation and the estimated gap, this indicates a continued need to increase the supply of graduates to support demand for accountants and auditors.

Fig. 30 and Fig. 31 provide further detail about the top 20 occupation gaps that reveal excess employer demand. The table includes the occupation title, occupation job zone, projected annual employer demand (for associate’s degrees and higher), the annual supply of program completions (allocated to the occupation), the total gap, and a ratio of supply to demand (S/D Ratio).

Fig. 30: Top 20 Demand Gaps for Skilled Occupations in Pennsylvania



Source: BLS (QCEW and OES); Pennsylvania Department of Labor & Industry; Oxford Economics Projections; NCES (IPEDS 2011-2013 Completions)

Fig. 31: Top 20 Demand Gaps for Skilled Occupations in Pennsylvania

Occupation Title	Job Zone	Average Annual Demand	Average Annual Supply	Total Gap	S/D Ratio
Registered Nurses	3	5,211	4,587	624	0.88
Accountants and Auditors	4	2,350	1,856	494	0.79
Sales Representatives, Services, All Other	4	1,110	671	439	0.60
Computer Systems Analysts	4	1,132	747	385	0.66
Maintenance and Repair Workers, General	3	392	28	364	0.07
Computer Programmers	4	891	543	348	0.61
Licensed Practical and Licensed Vocational Nurses	3	450	104	346	0.23
Software Developers, Applications	4	1,081	811	270	0.75
Dental Hygienists	3	455	191	264	0.42
Market Research Analysts and Marketing Specialists	4	1,127	896	231	0.80
Insurance Sales Agents	4	431	216	215	0.50
Medical and Clinical Laboratory Technologists	4	261	52	209	0.20
Hairdressers, Hairstylists, and Cosmetologists	3	184	29	155	0.16
Sales Representatives, Wholesale and Manufacturing, Except Technical and Scientific Products	4	706	557	149	0.79
Industrial Machinery Mechanics	3	161	18	143	0.11
Claims Adjusters, Examiners, and Investigators	4	361	220	141	0.61
Secretaries and Administrative Assistants, Except Legal, Medical, and Executive	3	1,378	1,237	141	0.90
First-Line Supervisors of Mechanics, Installers, and Repairers	3	274	138	136	0.50
Cost Estimators	4	324	193	131	0.60
Personal Financial Advisors	4	494	371	123	0.75
Registered Nurses	3	5,211	4,587	624	0.88
Accountants and Auditors	4	2,350	1,856	494	0.79
Sales Representatives, Services, All Other	4	1,110	671	439	0.60
Computer Systems Analysts	4	1,132	747	385	0.66
Maintenance and Repair Workers, General	3	392	28	364	0.07
Computer Programmers	4	891	543	348	0.61
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Software Developers, Applications	4	1,081	811	270	0.75
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Market Research Analysts and Marketing Specialists	4	1,127	896	231	0.80

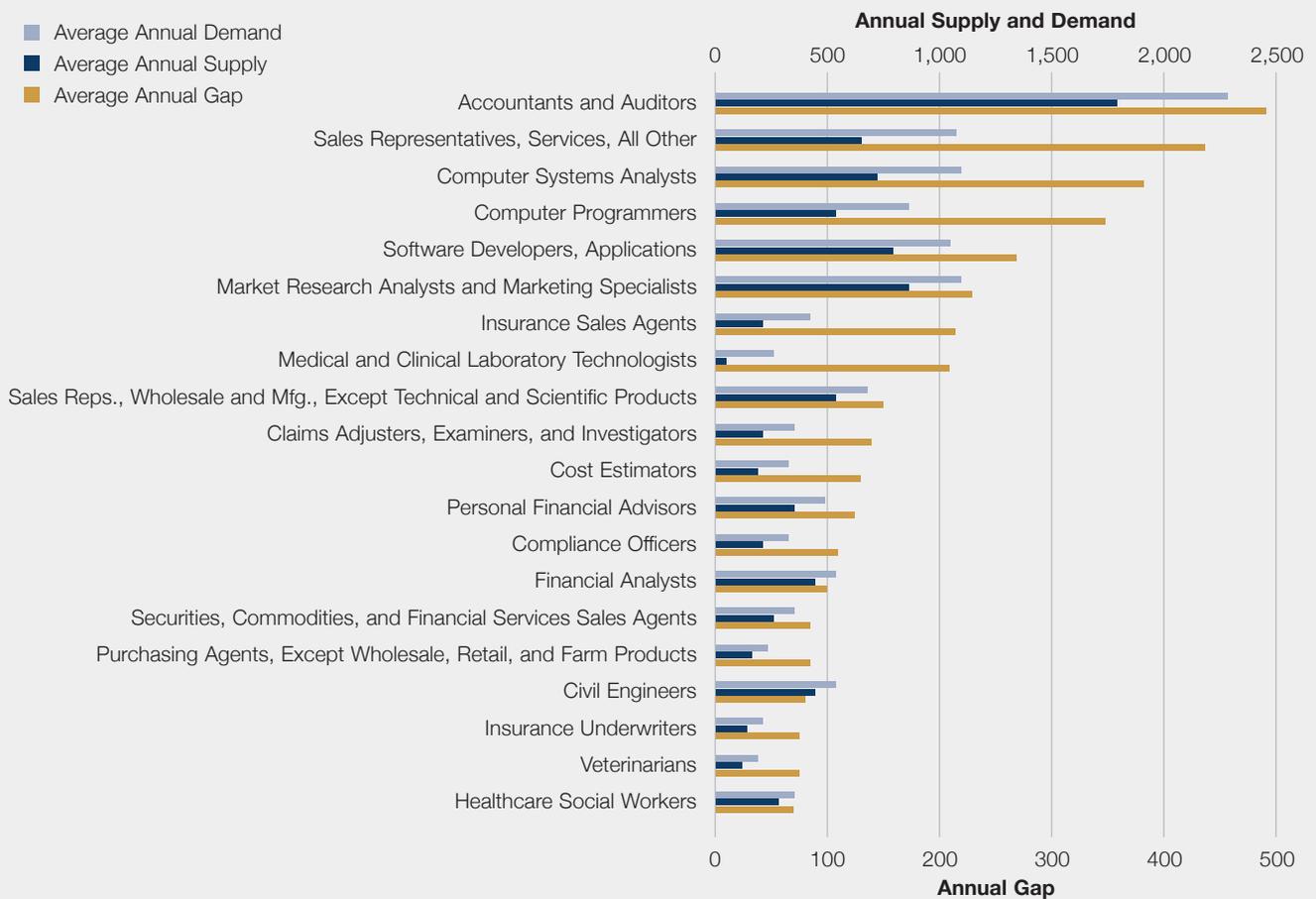
Source: BLS (QCEW and OES); Pennsylvania Department of Labor & Industry; Oxford Economics Projections; NCES (IPEDS 2011-2013 Completions)

5.3 Excess Demand Gaps for Occupations Aligning to Bachelor’s and Graduate Degrees

This section focuses on demand gaps for occupations that typically require a bachelor’s or higher degree—occupations categorized by Job Zones Four and Five. Recall that a demand gap exists where the regional supply of talent is insufficient to support the workforce needs of businesses located there.

Accountants and auditors show the largest demand gap for occupations aligning to bachelor and graduate degrees, however three of the top five demand gaps at the bachelor and graduate degree level are occupations related to computer and information systems, including: computer systems analysts, computer programmers and software developers, applications. Combined these three computer occupations indicate an annual demand gap of nearly 1,000.

Fig. 30: Top 20 Demand Gaps for Skilled Occupations in Pennsylvania



Source: BLS (QCEW and OES); Pennsylvania Department of Labor & Industry; Oxford Economics Projections; NCES (IPEDS 2011-2013 Completions)

Additionally, growth in professional, technical and scientific services has driven significant demand for business occupations, such as market research analysts. Projections indicate a noteworthy demand gap between the annual new and replacement job openings (about 1,130) and the number of program completions allocated to the occupations (about 900), leaving a gap of about 230 completions for market research analysts.

Fig. 32 highlights the demand gap results for the top 20 bachelor's and graduate degree level occupations. Fig. 33 includes the occupation title, occupation job zone, projected annual employer demand (for associate's degrees and higher), the annual supply of program completions (allocated to the occupation), the total gap, and a ratio of supply to demand (S/D Ratio).

Fig. 33: Top 20 Bachelor's and Graduate Degree-Level Demand Gaps and Top Employing Industry

Occupation Title	Job Zone	Average Annual Demand	Average Annual Supply	Total Gap	S/D Ratio
Accountants and Auditors	4	2,350	1,856	494	0.79
Sales Representatives, Services, All Other	4	1,110	671	439	0.60
Computer Systems Analysts	4	1,132	747	385	0.66
Computer Programmers	4	891	543	348	0.61
Software Developers, Applications	4	1,081	811	270	0.75
Market Research Analysts and Marketing Specialists	4	1,127	896	231	0.80
Insurance Sales Agents	4	431	216	215	0.50
Medical and Clinical Laboratory Technologists	4	261	52	209	0.20
Sales Representatives, Wholesale and Manufacturing, Except Technical and Scientific Products	4	706	557	149	0.79
Claims Adjusters, Examiners, and Investigators	4	361	220	141	0.61
Cost Estimators	4	324	193	131	0.60
Personal Financial Advisors	4	494	371	123	0.75
Compliance Officers	4	330	218	112	0.66
Financial Analysts	4	554	455	99	0.82
Securities, Commodities, and Financial Services Sales Agents	4	350	264	86	0.75
Purchasing Agents, Except Wholesale, Retail, and Farm Products	4	243	160	83	0.66
Civil Engineers	4	544	466	78	0.86
Insurance Underwriters	4	206	132	74	0.64
Veterinarians	5	191	118	73	0.62
Healthcare Social Workers	5	368	296	72	0.80

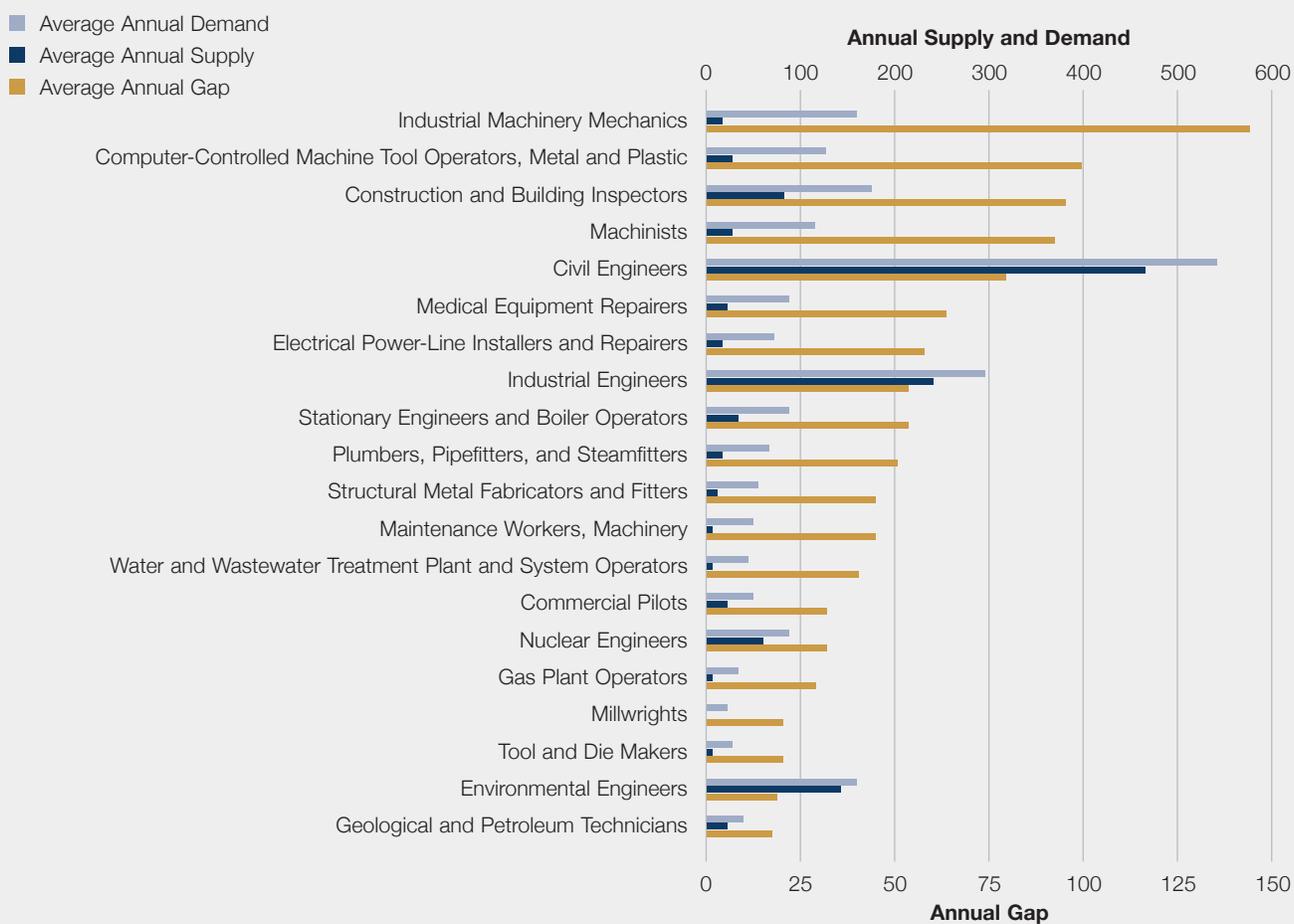
Source: BLS (QCEW and OES); Pennsylvania Department of Labor & Industry; Oxford Economics Projections; NCES (IPEDS 2011-2013 Completions)

5.4 Excess Demand Gaps for Occupations Without a State System Match

The breadth of programs offered at State System universities indicates a number of strong linkages to occupations. However, many occupations within Pennsylvania show excess demand for which State System universities did not produce completers in a matching program area. Furthermore, analysis indicates continued demand for these occupations over the next decade. Recall that a demand gap exists where the regional supply of talent is insufficient to support the workforce needs of businesses located there.

Fig. 34 displays the top 20 gaps for occupations that did not have matching State System University program completers. Industrial machinery mechanics

Fig. 34: Top 20 Demand Gaps for Skilled Occupations in Pennsylvania Without a State System Match



Source: BLS (QCEW and OES); Pennsylvania Department of Labor & Industry; Oxford Economics Projections; NCES (IPEDS 2011-2013 Completions)

show the largest excess annual demand gap at 143. This is followed by: CNC machine operators, metals and plastics; construction and building inspectors; machinists; and civil engineers.³⁰

Fig. 35 provides detailed information for each occupation including job zones, annual supply, annual demand, annual gap, and the supply/demand ratio.

Fig. 35: Top 20 Demand Gaps for Skilled Occupations in Pennsylvania Without a State System Match

Occupation Title	Job Zone	Average Annual Demand	Average Annual Supply	Total Gap	S/D Ratio
Industrial Machinery Mechanics	3	161	18	143	0.11
Computer-Controlled Machine Tool Operators, Metal and Plastic	3	129	30	99	0.23
Construction and Building Inspectors	3	178	83	95	0.47
Machinists	3	118	27	91	0.23
Civil Engineers	4	544	466	78	0.86
Medical Equipment Repairers	3	86	23	63	0.27
Electrical Power-Line Installers and Repairers	3	72	15	57	0.21
Industrial Engineers	4	296	243	53	0.82
Stationary Engineers and Boiler Operators	3	86	33	53	0.38
Plumbers, Pipefitters, and Steamfitters	3	65	15	50	0.23
Structural Metal Fabricators and Fitters	3	57	12	45	0.21
Maintenance Workers, Machinery	3	50	6	44	0.12
Water and Wastewater Treatment Plant and System Operators	3	44	4	40	0.09
Commercial Pilots	3	52	20	32	0.38
Nuclear Engineers	4	90	59	31	0.66
Gas Plant Operators	3	31	3	28	0.10
Millwrights	3	22	2	20	0.09
Tool and Die Makers	3	26	6	20	0.23
Environmental Engineers	5	161	142	19	0.88
Geological and Petroleum Technicians	4	40	23	17	0.58

Source: BLS (QCEW and OES); Pennsylvania Department of Labor & Industry; Oxford Economics Projections; NCES (IPEDS 2011-2013 Completions)

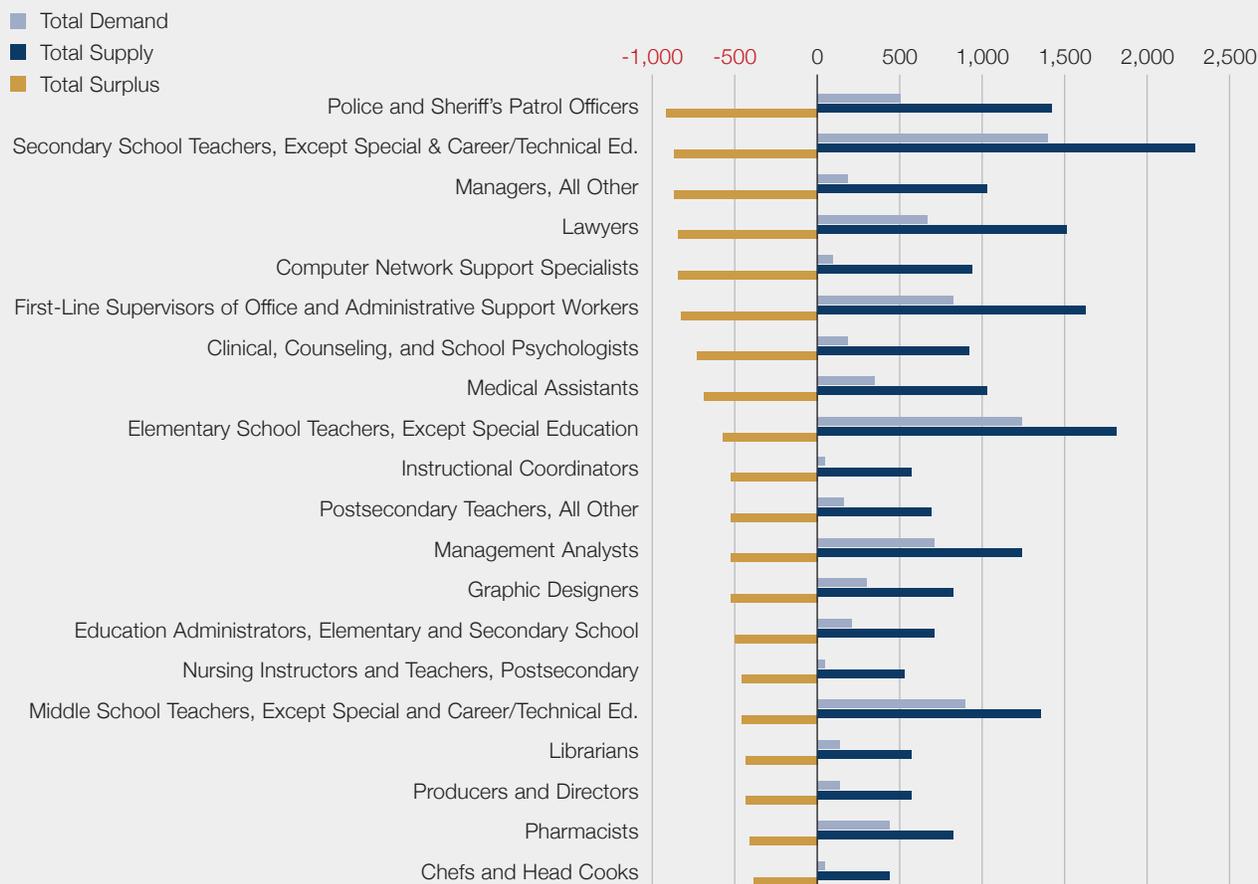
³⁰ Hairdressers, hairstylists and cosmetologists were removed from this list, as the program is typically aligned to a one-year vocational award, rather than an associate's degree—though associate's degrees are offered by a few post-secondary institutions in Pennsylvania.

5.5 Supply Surplus Gaps

Supply surplus gaps for skilled occupations cover occupations in Job Zones Three, Four and Five. The degree programs that align to these occupations span associate’s degrees through graduate degrees. Recall that a supply surplus for an occupation exists where the number of program completions within a region exceeds the employer demand. The top supply surplus gaps are identified by the size of the annual gap.

The top supply surpluses within Pennsylvania cover a broad range of both technical and non-technical occupations. When considering program changes in degree areas related to occupations displaying a supply surplus, further research should be considered to confirm the extent of alignment needed to arrive at equilibrium with the labor market.

Fig. 36: Top 20 Surpluses for Skilled Occupations in Pennsylvania



Source: BLS (QCEW and OES); Pennsylvania Department of Labor & Industry; Oxford Economics Projections; NCES (IPEDS 2011-2013 Completions)

Data reveal the number of graduates aligned to police and sheriff's patrol officers greatly exceed the average annual demand for these workers with this degree by over 900 completions. Other occupations that indicate a supply surplus include: secondary school teachers; managers, all other;³¹ lawyers, and computer network and support specialists. Program completers in the top surplus occupations may face increased competition for occupations related to their field of study within Pennsylvania.

Fig. 36 illustrates the top 20 supply surpluses for skilled occupations. Fig. 37 provides the occupation title, occupation job zone, projected annual employer demand (for associate's degrees and higher), the annual supply of program completions (allocated to the occupation), the total gap, and a ratio of supply to demand (S/D Ratio).

Fig. 37: Top 20 Surpluses for Skilled Occupations in Pennsylvania

Occupation Title	Job Zone	Average Annual Demand	Average Annual Supply	Total Gap	S/D Ratio
Police and Sheriff's Patrol Officers	3	501	1,424	-923	2.84
Secondary School Teachers, Except Special and Career/Technical Education	4	1,412	2,296	-884	1.63
Managers, All Other	4	174	1,038	-864	5.97
Lawyers	5	665	1,527	-862	2.30
Computer Network Support Specialists	4	91	948	-857	10.42
First-Line Supervisors of Office and Administrative Support Workers	3	819	1,638	-819	2.00
Clinical, Counseling, and School Psychologists	5	186	921	-735	4.95
Medical Assistants	3	356	1,036	-680	2.91
Elementary School Teachers, Except Special Education	4	1,245	1,811	-566	1.45
Instructional Coordinators	5	48	585	-537	12.19
Postsecondary Teachers, All Other	5	160	692	-532	4.33
Management Analysts	4	724	1,250	-526	1.73
Graphic Designers	4	294	817	-523	2.78
Education Administrators, Elementary and Secondary School	5	198	704	-506	3.56
Nursing Instructors and Teachers, Postsecondary	5	55	524	-469	9.53
Middle School Teachers, Except Special and Career/Technical Education	4	897	1,356	-459	1.51
Librarians	5	133	579	-446	4.35
Producers and Directors	4	140	567	-427	4.05
Pharmacists	5	429	833	-404	1.94
Chefs and Head Cooks	3	44	437	-393	9.93

Source: BLS (QCEW and OES); Pennsylvania Department of Labor & Industry; Oxford Economics Projections; NCES (IPEDS 2011-2013 Completions)

³¹ Managers, all other is a category for a wide range of management titles, including: regulatory affairs managers, investment fund managers, security managers, and wind energy project managers

This section provided an overview of gaps from the perspective of excess demand and supply surpluses. It is intended to set the data-driven foundation for understanding current alignment of education production in Pennsylvania compared to the state's employer demand for graduates in specific program areas. Results for the gaps are largely driven by industry employment growth. As market conditions change, the resulting demand for skilled workers will also change. Therefore, results of this analysis should be taken into context of changing industry sector employment and occupational demand.

6. CONCLUSION

The State System Gap Analysis report provides a data-driven foundation for program planning and alignment in order to drive economic value and career success within the Commonwealth. The analysis itself is not the solution, but can lend credible insight to guide decision making at the strategic level. The content is designed to be a starting point and resource for program evaluation and planning.

It is important to remember that the results for the gaps are largely driven by industry employment growth. As labor market conditions change, the resulting demand for skilled workers will also change. Therefore, the results of this analysis should be taken in a context of changing industry sector employment and occupational demand.

Additionally, areas of future research should be considered when considering program evaluation and planning. These areas include (but are not limited to):

- Strong vs. weak occupation to education alignment
- Wage trend research and supply/demand effects on wages
- Career pathways, outcomes, and lifetime earnings
- Issues of mal-employment³² and underemployment³³
- Program alignment best practices

As more insights into the connections between education programs and labor market outcomes are gained, students, universities, workers, and employers will all benefit significantly.

32 Mal-employment is a specific type of underemployment that exists in the labor market. This occurs when college-educated workers choose to work in occupations that do not utilize the skills and abilities gained in college. An example of this would include a person who has a bachelor's degree in political science but works as bartender. For more on mal-employment see Harrington and Fogg (2011) "Rising Mal-Employment and the Great Recession: The Growing Disconnection between Recent College Graduates and the College Labor Market."

33 Underemployment occurs in the labor market when workers' skills, experience, and willingness to work are not fully utilized. An example of this would include a person who is employed part-time but wants to work full-time.

7. ABOUT THE STATE SYSTEM'S GAP ANALYSIS PROJECT

The gap analysis methodology and report was produced through a multi-organization collaboration that consisted of Pennsylvania's State System of Higher Education Office of the Chancellor and Oxford Economics USA Inc. — the team. Throughout the project and research process, the team sought feedback and insight from senior administration and representatives from each of the 14 State System Universities. The team also drew on insight and feedback from subject matter experts involved in labor market intelligence and education program alignment.

The modeling and results presented here are based on information provided by third parties, upon which Oxford Economics has relied in producing its report and forecasts in good faith. Any subsequent revision or update of those data will affect the assessments and projections shown.

Oxford Economics is a key adviser to corporate, financial, government and education decision-makers and thought leaders. Oxford Economics' worldwide client base now comprises over 1000 international organizations, including leading multinational companies and financial institutions; key government bodies and trade associations; and top universities, consultancies, and think tanks.

This report is confidential to stakeholders of Pennsylvania's State System of Higher Education and may not be published or distributed without their prior written permission. Contact information for such request is provided below:

Dr. Sue Mukherjee

Executive Director for Program Alignment and Policy Development

Phone: (717) 720-4201

Email: SMukherjee@passhe.edu

8. DATA SOURCES KEY

Bureau of Labor Statistics (BLS):

- QCEW - Quarterly Census of Employment & Wages - <http://www.bls.gov/cew/>
- OES – Occupational Employment Statistics - <http://www.bls.gov/oes/>
- LAUS – Local Area Unemployment Statistics - <http://www.bls.gov/lau/>

U.S. Census Bureau (Census):

- LEHD – Longitudinal Employer-Household Dynamics - <http://lehd.census.gov/>
- ACS – American Community Survey - <http://www.census.gov/acs/www/>
- SAIPe – Small Area Income and Poverty Estimates - <http://www.census.gov/did/www/saipe/>

National Center for Education Statistics (NCES):

- IPEDS – Integrated Postsecondary Education Data System (National Center for Education Statistics) - <https://nces.ed.gov/ipeds/>

Pennsylvania Department of Labor and Industry (PADLI):

- www.paworkstats.pa.gov

O*NET Resource Center (O*NET)

- Job Zones – www.onetonline.org/help/online/zones

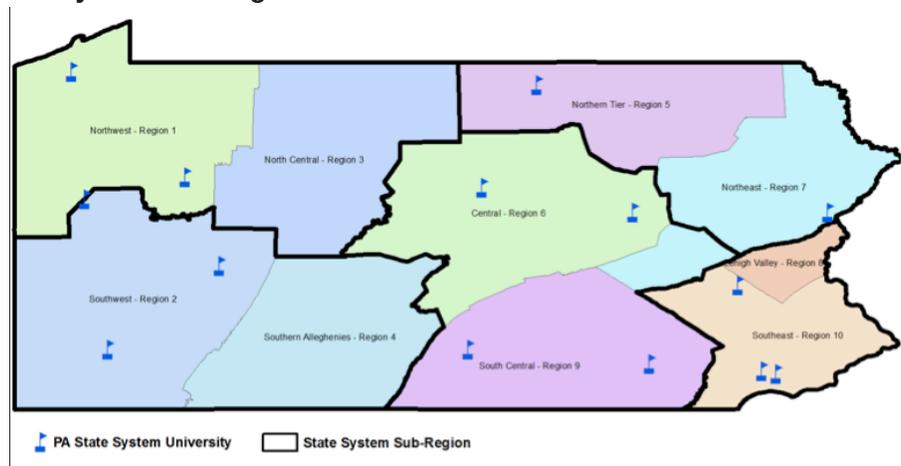
Economic Modeling Specialists International (EMSI)

APPENDIX A: STATE SYSTEM SUB-REGIONS WITH PREP REGIONS AND WIA REGIONS

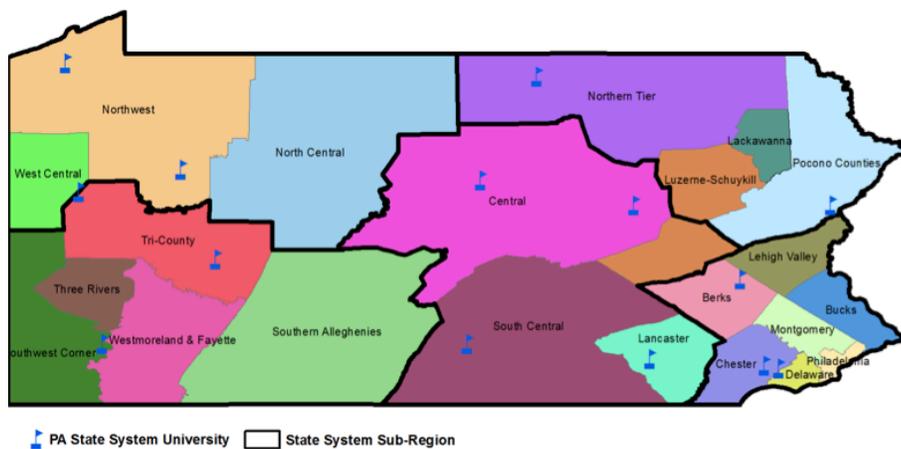
Partnerships for Regional Economic Performance (PREP) regions provide geographic context of how the Pennsylvania Department of Community & Economic Development divides resources and services to support business development, start-ups, investment and other economic development initiatives. To define sub-regions for this project, PREP regions served as the starting point. The following figures outline the sub regions in relation to PREP regions.

An additional map of Pennsylvania's Workforce Investment Act (WIA) regional boundaries is also provided.

State System Sub-regions and PREP Boundaries



State System Sub-regions and WIA Boundaries



APPENDIX B: O*NET JOB ZONE CODES

The O*NET program is the nation's primary source of occupational information. Central to the project is the O*NET database, containing information on hundreds of standardized and occupation-specific descriptors. The database, which is available to the public at no cost, is continually updated by surveying a broad range of workers from each occupation.³⁴

JOB ZONE ONE: Little or No Preparation Needed

- *Education* – Some of these occupations may require a high school diploma or GED certificate.
- *Related Experience* – Little or no previous work-related skill, knowledge, or experience is needed for these occupations. For example, a person can become a waiter or waitress even if he/she has never worked before.
- *Job Training* – Employees in these occupations need anywhere from a few days to a few months of training. Usually, an experienced worker could show you how to do the job.
- *Job Zone Examples* – These occupations involve following instructions and helping others. Examples include taxi drivers, amusement and recreation attendants, counter and rental clerks, nonfarm animal caretakers, continuous mining machine operators, and waiters/waitresses.

JOB ZONE TWO: Some Preparation Needed

- *Education* – These occupations usually require a high school diploma.
- *Related Experience* – Some previous work-related skill, knowledge, or experience is usually needed. For example, a teller would benefit from experience working directly with the public.
- *Job Training* – Employees in these occupations need anywhere from a few months to one year of working with experienced employees. A recognized apprenticeship program may be associated with these occupations.

³⁴ <http://www.onetcenter.org/overview.html>

- *Job Zone Examples* – These occupations often involve using your knowledge and skills to help others. Examples include sheet metal workers, forest fire fighters, customer service representatives, physical therapist aides, salespersons (retail), and tellers.

JOB ZONE THREE: Medium Preparation Needed

- *Education* – Most occupations in this zone require training in vocational schools, related on-the-job experience, or an associate's degree.
- *Related Experience* – Previous work-related skill, knowledge, or experience is required for these occupations. For example, an electrician must have completed three or four years of apprenticeship or several years of vocational training, and often must have passed a licensing exam, in order to perform the job.
- *Job Training* – Employees in these occupations usually need one or two years of training involving both on-the-job experience and informal training with experienced workers. A recognized apprenticeship program may be associated with these occupations.
- *Job Zone Examples* – These occupations usually involve using communication and organizational skills to coordinate, supervise, manage, or train others to accomplish goals. Examples include food service managers, electricians, agricultural technicians, legal secretaries, occupational therapy assistants, and medical assistants.

JOB ZONE FOUR: Considerable Preparation Needed

- *Education* – Most of these occupations require a four-year bachelor's degree, but some do not.
- *Related Experience* – A considerable amount of work-related skill, knowledge, or experience is needed for these occupations. For example, an accountant must complete four years of college and work for several years in accounting to be considered qualified.
- *Job Training* – Employees in these occupations usually need several years of work-related experience, on-the-job training, and/or vocational training.
- *Job Zone Examples* – Many of these occupations involve coordinating, supervising, managing, or training others. Examples include accountants, sales managers, database administrators, teachers, chemists, art directors, and cost estimators.

JOB ZONE FIVE: Extensive Preparation Needed

- *Education* – Most of these occupations require graduate school. For example, they may require a master’s degree, and some require a Ph.D., M.D., or J.D. (law degree).
- *Related Experience* – Extensive skill, knowledge, and experience are needed for these occupations. Many require more than five years of experience. For example, surgeons must complete four years of college and an additional five to seven years of specialized medical training to be able to do their job.
- *Job Training* – Employees may need some on-the-job training, but most of these occupations assume that the person will already have the required skills, knowledge, work-related experience, and/or training.
- *Job Zone Examples* – These occupations often involve coordinating, training, supervising, or managing the activities of others to accomplish goals. Very advanced communication and organizational skills are required. Examples include librarians, lawyers, sports medicine physicians, wildlife biologists, school psychologists, surgeons, treasurers, and controllers.

APPENDIX C: STRONG, LIMITED AND WEAK EDUCATION PROGRAM TO OCCUPATION CONNECTIONS³⁵

	Direct Connection	Limited Connection	Weak Connection
Surplus	Definitive surplus of graduates to projected demand; indicates strong market relationship between CIP and SOC(s) suggesting limited need for additional investments in program.	Apparent surplus of graduates in most related occupations. Likely intense competition for limited job opportunities. Moderate occupation ties require identification of special market links prior to added program investments.	Data indicates surplus of graduates likely, however the weak connection of the education program to specific occupations does not conform to traditional supply/demand data analysis.
Balanced	Balanced supply of graduates relative to demand. Job competition for newly minted graduates will be competitive, but opportunities in related occupations exist.	Apparent balanced supply of graduates relative to job demand in most related occupations. Data may be indeterminate relative to labor surplus or shortage situation. Added program review required to determine if greater labor market opportunities are present due to emerging or evolving occupations.	Data indicates balanced supply of graduates likely, but the weak connection to specific occupations does not conform to traditional supply/demand data analysis. Review occupational connections in CIP to SOC crosswalk to determine possible job market opportunities.
Gap	Definitive gap of completers relative to occupation demand. Data indicates likely shortages. Program is a strong candidate for additional resources and targeted recruitment efforts increase supply.	Apparent gap of graduates relative to job demand in at least one closely related occupation. Job opportunities may exist in at least one other related occupation. More research worthwhile to determine possible added occupation connections.	Data indicates gap of graduates likely, but weak connection to specific occupations does not conform to traditional supply/demand data analysis. Related jobs may exist but are not directly connected to the program. Review crosswalk for possible occupation links.

³⁵ The relationship matrix is drawn from: Labor Supply/Demand Analysis: Approaches and Concerns (2010) by Richard Froeschle formerly of the Texas Workforce Commission's Labor Market and Career Information (LMCI). While this context is important to know, Oxford Economics' methodology sought to minimize these issues by developing a crosswalk that uses real world education program to occupation matches through U.S. Census ACS data to more closely reflect the careers program completers actually enter into after graduation.

APPENDIX D: 4-DIGIT INDUSTRY EMPLOYMENT PROJECTIONS

The table below displays the employment numbers for industries at the four-digit NAICS level in Pennsylvania in 2010, 2014, and 2024. It also provides the detailed NAICS code, industry title, 2014 industry LQ, and projected job growth to 2024.

NAICS Code	Industry Title	2014 LQ	2010 Jobs	2014 Jobs	2024 Jobs	Job Change 2014-2024	% Change 2014-2024
Total	All Industries	1.0	5,472,154	5,643,677	6,179,890	536,213	9.5%
1111	Oilseed and Grain Farming	0.3	482	715	799	84	11.7%
1112	Vegetable and Melon Farming	0.3	1,001	1,283	1,382	99	7.7%
1113	Fruit and Tree Nut Farming	0.2	1,802	1,752	1,870	118	6.7%
1114	Greenhouse, Nursery, and Floriculture Production	1.6	9,970	9,303	9,486	183	2.0%
1119	Other Crop Farming	0.1	161	344	387	43	12.5%
1121	Cattle Ranching and Farming	0.5	2,642	3,167	3,435	268	8.5%
1122	Hog and Pig Farming	0.3	342	383	407	24	6.3%
1123	Poultry and Egg Production	1.1	1,553	1,798	1,901	103	5.7%
1124	Sheep and Goat Farming	0.5	21	31	37	6	19.4%
1125	Aquaculture	0.8	262	219	243	24	11.0%
1129	Other Animal Production	1.0	794	780	817	37	4.7%
1131	Timber Tract Operations	0.3	68	99	120	21	21.2%
1132	Forest Nurseries and Gathering of Forest Products	0.5	31	44	48	4	9.1%
1133	Logging	0.3	641	650	646	-4	-0.6%
1141	Fishing	0.0	29	8	9	1	12.5%
1142	Hunting and Trapping	0.7	29	53	48	-5	-9.4%
1151	Support Activities for Crop Production	0.2	1,909	2,138	2,503	365	17.1%
1152	Support Activities for Animal Production	1.0	1,041	1,105	1,237	132	11.9%
1153	Support Activities for Forestry	0.2	138	161	192	31	19.3%
2111	Oil and Gas Extraction	0.8	3,807	6,396	8,223	1,827	28.6%
2121	Coal Mining	2.4	7,772	7,307	6,010	-1,297	-17.8%
2122	Metal Ore Mining	0.0	57	21	24	3	14.3%
2123	Nonmetallic Mineral Mining and Quarrying	1.3	5,002	4,997	5,085	88	1.8%
2131	Support Activities for Mining	1.0	9,365	18,277	20,546	2,269	12.4%

NAICS Code	Industry Title	2014 LQ	2010 Jobs	2014 Jobs	2024 Jobs	Job Change 2014-2024	% Change 2014-2024
2211	Electric Power Generation, Transmission and Distribution	0.7	15,710	14,756	13,864	-892	-6.0%
2212	Natural Gas Distribution	1.1	4,745	5,497	5,700	203	3.7%
2213	Water, Sewage and Other Systems	1.4	11,470	11,878	12,645	767	6.5%
2361	Residential Building Construction	1.0	25,843	26,489	33,188	6,699	25.3%
2362	Nonresidential Building Construction	0.9	23,113	26,151	30,760	4,609	17.6%
2371	Utility System Construction	1.1	16,950	21,175	27,069	5,894	27.8%
2372	Land Subdivision	0.7	1,101	1,179	1,453	274	23.2%
2373	Highway, Street, and Bridge Construction	1.2	21,092	20,311	25,575	5,264	25.9%
2379	Other Heavy and Civil Engineering Construction	0.5	2,241	2,252	2,850	598	26.6%
2381	Foundation, Structure, and Building Exterior Contractors	0.8	24,391	24,833	28,478	3,645	14.7%
2382	Building Equipment Contractors	0.9	63,699	67,158	78,706	11,548	17.2%
2383	Building Finishing Contractors	0.8	21,437	21,697	24,197	2,500	11.5%
2389	Other Specialty Trade Contractors	1.2	25,159	28,219	33,999	5,780	20.5%
3111	Animal Food Manufacturing	1.7	3,735	3,768	3,796	28	0.7%
3112	Grain and Oilseed Milling	0.4	1,095	987	999	12	1.2%
3113	Sugar and Confectionery Product Manufacturing	3.3	9,129	9,580	9,836	256	2.7%
3114	Fruit and Vegetable Preserving and Specialty Food Manufacturing	1.0	7,647	7,236	7,222	-14	-0.2%
3115	Dairy Product Manufacturing	1.2	6,615	6,451	6,237	-214	-3.3%
3116	Animal Slaughtering and Processing	0.8	13,818	15,283	16,731	1,448	9.5%
3117	Seafood Product Preparation and Packaging	0.1	77	102	120	18	17.6%
3118	Bakeries and Tortilla Manufacturing	1.2	14,391	14,751	14,613	-138	-0.9%
3119	Other Food Manufacturing	1.5	9,991	11,379	12,468	1,089	9.6%
3121	Beverage Manufacturing	0.9	5,916	7,393	8,551	1,158	15.7%
3122	Tobacco Manufacturing	1.1	824	616	617	1	0.2%
3131	Fiber, Yarn, and Thread Mills	0.3	311	312	258	-54	-17.3%
3132	Fabric Mills	1.0	2,480	2,228	1,819	-409	-18.4%
3133	Textile and Fabric Finishing and Fabric Coating Mills	0.6	990	874	730	-144	-16.5%
3141	Textile Furnishings Mills	0.8	1,503	1,761	1,339	-422	-24.0%
3149	Other Textile Product Mills	1.0	2,508	2,476	2,320	-156	-6.3%
3151	Apparel Knitting Mills	0.4	575	245	191	-54	-22.0%
3152	Cut and Sew Apparel Manufacturing	0.8	5,522	3,862	2,831	-1,031	-26.7%
3159	Apparel Accessories and Other Apparel Manufacturing	0.9	640	450	380	-70	-15.6%
3161	Leather and Hide Tanning and Finishing	2.2	148	402	477	75	18.7%
3162	Footwear Manufacturing	0.4	496	243	221	-22	-9.1%
3169	Other Leather and Allied Product Manufacturing	0.6	179	272	297	25	9.2%

NAICS Code	Industry Title	2014 LQ	2010 Jobs	2014 Jobs	2024 Jobs	Job Change 2014-2024	% Change 2014-2024
3211	Sawmills and Wood Preservation	1.1	3,945	3,998	5,104	1,106	27.7%
3212	Veneer, Plywood, and Engineered Wood Product Manufacturing	1.0	2,697	2,882	3,621	739	25.6%
3219	Other Wood Product Manufacturing	1.7	12,756	14,599	18,389	3,790	26.0%
3221	Pulp, Paper, and Paperboard Mills	0.8	3,491	3,305	3,417	112	3.4%
3222	Converted Paper Product Manufacturing	1.8	21,330	20,287	20,413	126	0.6%
3231	Printing and Related Support Activities	1.3	28,261	24,746	21,797	-2,949	-11.9%
3241	Petroleum and Coal Products Manufacturing	1.3	6,316	5,998	5,911	-87	-1.5%
3251	Basic Chemical Manufacturing	1.0	5,572	5,718	5,609	-109	-1.9%
3252	Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Manufacturing	0.8	2,927	3,030	2,976	-54	-1.8%
3253	Pesticide, Fertilizer, and Other Agricultural Chemical Manufacturing	0.4	614	682	713	31	4.5%
3254	Pharmaceutical and Medicine Manufacturing	1.5	21,345	17,570	16,511	-1,059	-6.0%
3255	Paint, Coating, and Adhesive Manufacturing	1.0	2,670	2,592	2,485	-107	-4.1%
3256	Soap, Cleaning Compound, and Toilet Preparation Manufacturing	1.4	5,646	6,049	6,020	-29	-0.5%
3259	Other Chemical Product and Preparation Manufacturing	1.3	4,191	4,309	4,387	78	1.8%
3261	Plastics Product Manufacturing	1.4	31,164	31,436	32,759	1,323	4.2%
3262	Rubber Product Manufacturing	0.9	3,991	4,663	5,026	363	7.8%
3271	Clay Product and Refractory Manufacturing	1.6	2,521	2,630	2,730	100	3.8%
3272	Glass and Glass Product Manufacturing	1.6	5,995	5,467	5,747	280	5.1%
3273	Cement and Concrete Product Manufacturing	1.2	8,780	8,818	9,532	714	8.1%
3274	Lime and Gypsum Product Manufacturing	1.1	598	680	757	77	11.3%
3279	Other Nonmetallic Mineral Product Manufacturing	0.9	3,484	2,593	2,795	202	7.8%
3311	Iron and Steel Mills and Ferroalloy Manufacturing	3.6	12,664	13,428	13,350	-78	-0.6%
3312	Steel Product Manufacturing from Purchased Steel	2.6	6,101	6,528	6,546	18	0.3%
3313	Alumina and Aluminum Production and Processing	1.4	2,913	3,297	3,645	348	10.6%
3314	Nonferrous Metal (except Aluminum) Production and Processing	2.4	6,345	6,214	6,323	109	1.8%
3315	Foundries	1.8	7,980	9,410	9,599	189	2.0%
3321	Forging and Stamping	2.5	9,512	10,359	10,898	539	5.2%
3322	Cutlery and Handtool Manufacturing	1.4	2,771	2,265	2,325	60	2.6%
3323	Architectural and Structural Metals Manufacturing	1.4	20,508	20,624	23,277	2,653	12.9%
3324	Boiler, Tank, and Shipping Container Manufacturing	1.2	4,919	4,950	5,307	357	7.2%
3325	Hardware Manufacturing	0.7	844	652	697	45	6.9%
3326	Spring and Wire Product Manufacturing	1.7	2,705	3,044	3,236	192	6.3%
3327	Machine Shops; Turned Product; and Screw, Nut, and Bolt Manufacturing	1.5	20,374	22,385	22,995	610	2.7%

NAICS Code	Industry Title	2014 LQ	2010 Jobs	2014 Jobs	2024 Jobs	Job Change 2014-2024	% Change 2014-2024
3328	Coating, Engraving, Heat Treating, and Allied Activities	1.0	5,408	5,756	6,170	414	7.2%
3329	Other Fabricated Metal Product Manufacturing	1.0	10,943	11,079	11,604	525	4.7%
3331	Agriculture, Construction, and Mining Machinery Manufacturing	0.9	8,660	9,608	9,537	-71	-0.7%
3332	Industrial Machinery Manufacturing	1.1	4,404	4,986	5,218	232	4.7%
3333	Commercial and Service Industry Machinery Manufacturing	0.8	3,791	2,719	2,425	-294	-10.8%
3334	Ventilation, Heating, Air-Conditioning, and Commercial Refrigeration Equipment Manufacturing	1.0	4,863	5,092	5,258	166	3.3%
3335	Metalworking Machinery Manufacturing	1.5	10,266	11,012	10,515	-497	-4.5%
3336	Engine, Turbine, and Power Transmission Equipment Manufacturing	0.7	3,131	3,070	2,779	-291	-9.5%
3339	Other General Purpose Machinery Manufacturing	1.1	10,190	11,630	12,106	476	4.1%
3341	Computer and Peripheral Equipment Manufacturing	0.2	1,630	1,515	1,458	-57	-3.8%
3342	Communications Equipment Manufacturing	0.9	3,849	3,462	2,974	-488	-14.1%
3343	Audio and Video Equipment Manufacturing	0.5	321	389	371	-18	-4.6%
3344	Semiconductor and Other Electronic Component Manufacturing	0.7	11,347	10,647	9,961	-686	-6.4%
3345	Navigational, Measuring, Electromedical, and Control Instruments Manufacturing	0.9	13,288	14,191	14,188	-3	0.0%
3346	Manufacturing and Reproducing Magnetic and Optical Media	1.5	1,534	1,026	1,017	-9	-0.9%
3351	Electric Lighting Equipment Manufacturing	1.1	2,156	2,113	2,123	10	0.5%
3352	Household Appliance Manufacturing	0.2	528	608	655	47	7.7%
3353	Electrical Equipment Manufacturing	1.2	7,108	7,360	7,547	187	2.5%
3359	Other Electrical Equipment and Component Manufacturing	3.0	14,880	15,892	17,211	1,319	8.3%
3361	Motor Vehicle Manufacturing	0.2	1,135	1,670	1,689	19	1.1%
3362	Motor Vehicle Body and Trailer Manufacturing	1.0	6,685	5,543	5,890	347	6.3%
3363	Motor Vehicle Parts Manufacturing	0.4	6,424	7,846	7,835	-11	-0.1%
3364	Aerospace Product and Parts Manufacturing	0.6	11,270	11,251	10,996	-255	-2.3%
3365	Railroad Rolling Stock Manufacturing	6.5	5,848	7,312	7,517	205	2.8%
3366	Ship and Boat Building	0.2	1,071	1,185	1,271	86	7.3%
3369	Other Transportation Equipment Manufacturing	2.8	4,350	3,695	4,232	537	14.5%
3371	Household and Institutional Furniture and Kitchen Cabinet Manufacturing	1.0	9,409	9,122	9,248	126	1.4%
3372	Office Furniture (including Fixtures) Manufacturing	1.2	4,117	4,969	5,386	417	8.4%
3379	Other Furniture Related Product Manufacturing	0.7	1,291	961	1,039	78	8.1%
3391	Medical Equipment and Supplies Manufacturing	1.1	14,947	13,628	13,099	-529	-3.9%
3399	Other Miscellaneous Manufacturing	1.1	11,754	12,579	12,105	-474	-3.8%

NAICS Code	Industry Title	2014 LQ	2010 Jobs	2014 Jobs	2024 Jobs	Job Change 2014-2024	% Change 2014-2024
4231	Motor Vehicle and Motor Vehicle Parts and Supplies Merchant Wholesalers	1.5	19,617	20,384	22,207	1,823	8.9%
4232	Furniture and Home Furnishing Merchant Wholesalers	0.7	2,916	2,821	3,022	201	7.1%
4233	Lumber and Other Construction Materials Merchant Wholesalers	1.2	8,982	9,661	10,560	899	9.3%
4234	Professional and Commercial Equipment and Supplies Merchant Wholesalers	0.8	22,618	21,207	20,846	-361	-1.7%
4235	Metal and Mineral (except Petroleum) Merchant Wholesalers	0.9	4,537	4,784	5,155	371	7.8%
4236	Household Appliances and Electrical and Electronic Goods Merchant Wholesalers	0.8	9,774	10,439	10,216	-223	-2.1%
4237	Hardware, and Plumbing and Heating Equipment and Supplies Merchant Wholesalers	1.0	8,835	9,293	10,610	1,317	14.2%
4238	Machinery, Equipment, and Supplies Merchant Wholesalers	0.9	24,325	25,600	27,630	2,030	7.9%
4239	Miscellaneous Durable Goods Merchant Wholesalers	0.8	9,296	9,836	11,607	1,771	18.0%
4241	Paper and Paper Product Merchant Wholesalers	1.0	4,937	4,866	4,918	52	1.1%
4242	Drugs and Druggists' Sundries Merchant Wholesalers	1.0	7,680	7,694	7,690	-4	-0.1%
4243	Apparel, Piece Goods, and Notions Merchant Wholesalers	0.5	2,423	3,024	3,085	61	2.0%
4244	Grocery and Related Product Merchant Wholesalers	0.9	26,717	27,325	30,030	2,705	9.9%
4245	Farm Product Raw Material Merchant Wholesalers	0.2	802	667	730	63	9.4%
4246	Chemical and Allied Products Merchant Wholesalers	0.8	4,396	4,452	4,807	355	8.0%
4247	Petroleum and Petroleum Products Merchant Wholesalers	0.9	3,868	3,861	4,012	151	3.9%
4248	Beer, Wine, and Distilled Alcoholic Beverage Merchant Wholesalers	0.5	3,664	3,962	4,539	577	14.6%
4249	Miscellaneous Nondurable Goods Merchant Wholesalers	0.7	9,733	9,516	9,231	-285	-3.0%
4251	Wholesale Electronic Markets and Agents and Brokers	1.3	48,865	46,815	47,349	534	1.1%
4411	Automobile Dealers	1.1	47,601	54,490	61,419	6,929	12.7%
4412	Other Motor Vehicle Dealers	0.7	3,945	4,175	4,588	413	9.9%
4413	Automotive Parts, Accessories, and Tire Stores	0.8	17,107	17,612	18,613	1,001	5.7%
4421	Furniture Stores	0.8	8,468	7,474	7,498	24	0.3%
4422	Home Furnishings Stores	0.8	7,803	8,005	8,162	157	2.0%
4431	Electronics and Appliance Stores	0.8	16,814	16,401	15,915	-486	-3.0%
4441	Building Material and Supplies Dealers	0.9	39,918	39,760	41,554	1,794	4.5%
4442	Lawn and Garden Equipment and Supplies Stores	1.0	6,298	6,345	6,551	206	3.2%
4451	Grocery Stores	1.2	125,796	126,049	127,480	1,431	1.1%
4452	Specialty Food Stores	1.1	10,603	10,142	10,066	-76	-0.7%
4453	Beer, Wine, and Liquor Stores	1.4	9,109	9,224	10,613	1,389	15.1%
4461	Health and Personal Care Stores	1.1	45,597	45,420	46,028	608	1.3%

NAICS Code	Industry Title	2014 LQ	2010 Jobs	2014 Jobs	2024 Jobs	Job Change 2014-2024	% Change 2014-2024
4471	Gasoline Stations	1.1	37,066	39,016	40,129	1,113	2.9%
4481	Clothing Stores	1.0	43,805	41,880	39,560	-2,320	-5.5%
4482	Shoe Stores	1.0	8,079	8,253	8,448	195	2.4%
4483	Jewelry, Luggage, and Leather Goods Stores	1.0	5,760	5,700	5,517	-183	-3.2%
4511	Sporting Goods, Hobby, and Musical Instrument Stores	1.0	18,895	21,117	22,269	1,152	5.5%
4512	Book Stores and News Dealers	1.0	5,701	3,596	3,251	-345	-9.6%
4521	Department Stores	0.9	60,061	51,947	46,335	-5,612	-10.8%
4529	Other General Merchandise Stores	0.8	51,515	58,842	64,490	5,648	9.6%
4531	Florists	1.3	3,741	3,324	2,616	-708	-21.3%
4532	Office Supplies, Stationery, and Gift Stores	0.9	12,728	11,433	10,019	-1,414	-12.4%
4533	Used Merchandise Stores	0.9	4,729	6,190	7,404	1,214	19.6%
4539	Other Miscellaneous Store Retailers	1.1	12,327	13,571	14,482	911	6.7%
4541	Electronic Shopping and Mail-Order Houses	1.3	15,581	17,434	20,777	3,343	19.2%
4542	Vending Machine Operators	1.2	1,983	1,760	1,664	-96	-5.5%
4543	Direct Selling Establishments	1.6	9,026	8,536	8,612	76	0.9%
4811	Scheduled Air Transportation	0.7	11,656	11,672	12,447	775	6.6%
4812	Nonscheduled Air Transportation	0.5	902	727	830	103	14.2%
4831	Deep Sea, Coastal, and Great Lakes Water Transportation	0.1	381	224	204	-20	-8.9%
4832	Inland Water Transportation	0.3	410	390	410	20	5.1%
4841	General Freight Trucking	1.1	40,373	44,045	52,941	8,896	20.2%
4842	Specialized Freight Trucking	1.1	16,988	19,672	24,177	4,505	22.9%
4851	Urban Transit Systems	0.6	5,815	5,676	6,252	576	10.1%
4852	Interurban and Rural Bus Transportation	0.9	895	805	820	15	1.9%
4853	Taxi and Limousine Service	0.7	2,090	2,262	2,358	96	4.2%
4854	School and Employee Bus Transportation	2.7	25,839	27,367	30,276	2,909	10.6%
4855	Charter Bus Industry	2.0	2,566	2,461	2,692	231	9.4%
4859	Other Transit and Ground Passenger Transportation	1.1	4,007	4,207	4,788	581	13.8%
4861	Pipeline Transportation of Crude Oil	0.0	0	0	0	0	#DIV/0!
4862	Pipeline Transportation of Natural Gas	1.2	1,291	1,460	1,815	355	24.3%
4869	Other Pipeline Transportation	2.0	552	642	778	136	21.2%
4871	Scenic and Sightseeing Transportation, Land	1.1	553	625	656	31	5.0%
4872	Scenic and Sightseeing Transportation, Water	0.5	319	308	329	21	6.8%
4879	Scenic and Sightseeing Transportation, Other	0.0	4	4	4	0	0.0%
4881	Support Activities for Air Transportation	0.5	4,117	4,303	5,010	707	16.4%
4882	Support Activities for Rail Transportation	1.2	1,214	1,596	2,006	410	25.7%
4883	Support Activities for Water Transportation	2.0	8,033	8,192	8,186	-6	-0.1%

NAICS Code	Industry Title	2014 LQ	2010 Jobs	2014 Jobs	2024 Jobs	Job Change 2014-2024	% Change 2014-2024
4884	Support Activities for Road Transportation	1.1	4,338	5,138	7,225	2,087	40.6%
4885	Freight Transportation Arrangement	0.6	4,028	4,633	5,523	890	19.2%
4889	Other Support Activities for Transportation	0.9	1,323	1,175	1,366	191	16.3%
4911	Postal Service	1.1	31,743	27,883	20,587	-7,296	-26.2%
4921	Couriers and Express Delivery Services	1.1	22,112	23,553	25,850	2,297	9.8%
4922	Local Messengers and Local Delivery	0.6	1,160	1,312	1,416	104	7.9%
4931	Warehousing and Storage	2.1	56,903	64,980	78,552	13,572	20.9%
5111	Newspaper, Periodical, Book, and Directory Publishers	1.2	25,230	19,717	16,257	-3,460	-17.5%
5112	Software Publishers	0.4	5,284	5,115	5,662	547	10.7%
5121	Motion Picture and Video Industries	0.5	7,116	7,240	7,399	159	2.2%
5122	Sound Recording Industries	0.4	391	255	243	-12	-4.7%
5151	Radio and Television Broadcasting	0.9	7,157	7,838	8,187	349	4.5%
5152	Cable and Other Subscription Programming	0.1	1,317	253	242	-11	-4.3%
5171	Wired Telecommunications Carriers	1.0	25,919	24,064	21,502	-2,562	-10.6%
5172	Wireless Telecommunications Carriers (except Satellite)	0.3	2,895	2,213	1,825	-388	-17.5%
5174	Satellite Telecommunications	0.3	170	108	97	-11	-10.2%
5179	Other Telecommunications	0.5	2,579	1,586	1,376	-210	-13.2%
5182	Data Processing, Hosting, and Related Services	0.9	10,397	10,128	9,864	-264	-2.6%
5191	Other Information Services	0.7	8,623	10,294	12,200	1,906	18.5%
5211	Monetary Authorities-Central Bank	0.1	1,269	101	82	-19	-18.8%
5221	Depository Credit Intermediation	1.1	81,856	77,318	72,001	-5,317	-6.9%
5222	Nondepository Credit Intermediation	0.5	12,930	13,075	12,736	-339	-2.6%
5223	Activities Related to Credit Intermediation	0.4	5,502	4,464	4,542	78	1.7%
5231	Securities and Commodity Contracts Intermediation and Brokerage	0.5	11,604	9,532	11,155	1,623	17.0%
5232	Securities and Commodity Exchanges	0.5	191	157	200	43	27.4%
5239	Other Financial Investment Activities	1.7	14,971	30,009	41,151	11,142	37.1%
5241	Insurance Carriers	1.5	73,266	74,714	77,859	3,145	4.2%
5242	Agencies, Brokerages, and Other Insurance Related Activities	1.1	40,145	46,222	54,367	8,145	17.6%
5251	Insurance and Employee Benefit Funds	1.0	2,628	94	76	-18	-19.1%
5259	Other Investment Pools and Funds	8.2	10,317	1,195	1,500	305	25.5%
5311	Lessors of Real Estate	0.7	18,195	18,839	20,403	1,564	8.3%
5312	Offices of Real Estate Agents and Brokers	0.6	7,933	7,241	7,685	444	6.1%
5313	Activities Related to Real Estate	0.6	13,029	14,716	16,510	1,794	12.2%
5321	Automotive Equipment Rental and Leasing	0.9	6,674	7,196	8,157	961	13.4%
5322	Consumer Goods Rental	0.8	6,516	5,111	5,787	676	13.2%

NAICS Code	Industry Title	2014 LQ	2010 Jobs	2014 Jobs	2024 Jobs	Job Change 2014-2024	% Change 2014-2024
5323	General Rental Centers	0.8	1,278	1,314	1,527	213	16.2%
5324	Commercial and Industrial Machinery and Equipment Rental and Leasing	1.1	4,579	6,369	7,900	1,531	24.0%
5331	Lessors of Nonfinancial Intangible Assets (except Copyrighted Works)	0.6	885	545	587	42	7.7%
5411	Legal Services	1.1	50,263	49,456	52,646	3,190	6.5%
5412	Accounting, Tax Preparation, Bookkeeping, and Payroll Services	0.9	32,951	34,488	37,182	2,694	7.8%
5413	Architectural, Engineering, and Related Services	1.1	58,929	62,528	70,402	7,874	12.6%
5414	Specialized Design Services	0.9	3,359	4,596	6,041	1,445	31.4%
5415	Computer Systems Design and Related Services	0.9	52,154	64,834	88,371	23,537	36.3%
5416	Management, Scientific, and Technical Consulting Services	0.9	41,337	47,606	56,499	8,893	18.7%
5417	Scientific Research and Development Services	1.0	30,724	27,821	32,608	4,787	17.2%
5418	Advertising, Public Relations, and Related Services	0.8	14,420	16,638	18,805	2,167	13.0%
5419	Other Professional, Scientific, and Technical Services	1.0	24,194	26,694	32,021	5,327	20.0%
5511	Management of Companies and Enterprises	1.5	117,398	132,758	151,533	18,775	14.1%
5611	Office Administrative Services	0.2	6,931	3,013	2,971	-42	-1.4%
5612	Facilities Support Services	1.3	2,598	7,107	9,497	2,390	33.6%
5613	Employment Services	0.8	89,352	108,361	142,374	34,013	31.4%
5614	Business Support Services	0.9	33,058	31,017	30,873	-144	-0.5%
5615	Travel Arrangement and Reservation Services	0.9	7,221	7,473	7,303	-170	-2.3%
5616	Investigation and Security Services	1.0	31,805	35,130	40,626	5,496	15.6%
5617	Services to Buildings and Dwellings	0.9	73,788	77,070	85,180	8,110	10.5%
5619	Other Support Services	1.3	11,434	16,065	20,454	4,389	27.3%
5621	Waste Collection	1.3	7,512	8,790	10,772	1,982	22.5%
5622	Waste Treatment and Disposal	0.7	3,897	3,701	4,340	639	17.3%
5629	Remediation and Other Waste Management Services	1.0	4,508	5,497	6,665	1,168	21.2%
6111	Elementary and Secondary Schools	0.9	323,873	293,433	284,320	-9,113	-3.1%
6112	Junior Colleges	0.7	22,154	19,599	19,470	-129	-0.7%
6113	Colleges, Universities, and Professional Schools	1.2	145,046	147,018	152,009	4,991	3.4%
6114	Business Schools and Computer and Management Training	0.5	2,164	1,488	1,552	64	4.3%
6115	Technical and Trade Schools	0.8	4,020	4,549	5,250	701	15.4%
6116	Other Schools and Instruction	0.8	10,615	11,964	13,553	1,589	13.3%
6117	Educational Support Services	0.8	6,597	4,738	5,552	814	17.2%
6211	Offices of Physicians	1.1	108,896	110,432	120,550	10,118	9.2%
6212	Offices of Dentists	0.9	33,096	33,605	37,333	3,728	11.1%
6213	Offices of Other Health Practitioners	1.3	37,916	42,072	55,213	13,141	31.2%
6214	Outpatient Care Centers	1.3	32,578	39,858	50,842	10,984	27.6%

NAICS Code	Industry Title	2014 LQ	2010 Jobs	2014 Jobs	2024 Jobs	Job Change 2014-2024	% Change 2014-2024
6215	Medical and Diagnostic Laboratories	1.1	10,953	11,186	13,110	1,924	17.2%
6216	Home Health Care Services	0.9	36,615	46,405	69,757	23,352	50.3%
6219	Other Ambulatory Health Care Services	1.7	19,686	20,808	25,540	4,732	22.7%
6221	General Medical and Surgical Hospitals	1.1	246,922	248,181	271,788	23,607	9.5%
6222	Psychiatric and Substance Abuse Hospitals	1.3	13,399	12,817	14,569	1,752	13.7%
6223	Specialty (except Psychiatric and Substance Abuse) Hospitals	2.5	21,232	25,123	33,972	8,849	35.2%
6231	Nursing Care Facilities (Skilled Nursing Facilities)	1.2	89,353	86,747	98,689	11,942	13.8%
6232	Residential Intellectual and Developmental Disability, Mental Health, and Substance Abuse Facilities	1.9	54,424	55,870	64,223	8,353	15.0%
6233	Continuing Care Retirement Communities and Assisted Living Facilities for the Elderly	1.9	62,012	67,910	83,119	15,209	22.4%
6239	Other Residential Care Facilities	1.1	9,514	7,847	9,119	1,272	16.2%
6241	Individual and Family Services	1.3	98,918	115,858	156,278	40,420	34.9%
6242	Community Food and Housing, and Emergency and Other Relief Services	1.0	6,569	6,574	7,790	1,216	18.5%
6243	Vocational Rehabilitation Services	0.8	12,735	11,183	13,218	2,035	18.2%
6244	Child Day Care Services	1.2	40,208	41,350	48,707	7,357	17.8%
7111	Performing Arts Companies	0.9	4,140	4,279	4,651	372	8.7%
7112	Spectator Sports	1.1	6,037	6,003	6,796	793	13.2%
7113	Promoters of Performing Arts, Sports, and Similar Events	1.2	5,244	6,225	7,246	1,021	16.4%
7114	Agents and Managers for Artists, Athletes, Entertainers, and Other Public Figures	0.2	226	183	201	18	9.8%
7115	Independent Artists, Writers, and Performers	0.5	1,006	1,039	1,208	169	16.3%
7121	Museums, Historical Sites, and Similar Institutions	0.8	7,464	8,204	9,334	1,130	13.8%
7131	Amusement Parks and Arcades	1.1	8,421	8,499	9,237	738	8.7%
7132	Gambling Industries	0.9	10,194	9,532	10,665	1,133	11.9%
7139	Other Amusement and Recreation Industries	0.9	49,000	50,039	56,373	6,334	12.7%
7211	Traveler Accommodation	0.7	47,534	54,602	59,608	5,006	9.2%
7212	RV (Recreational Vehicle) Parks and Recreational Camps	1.4	3,001	3,410	3,716	306	9.0%
7213	Rooming and Boarding Houses	0.5	277	298	337	39	13.1%
7223	Special Food Services	1.4	33,251	37,157	40,961	3,804	10.2%
7224	Drinking Places (Alcoholic Beverages)	1.1	17,597	16,795	17,189	394	2.3%
7225	Restaurants and Other Eating Places	0.8	310,868	334,874	368,731	33,857	10.1%
8111	Automotive Repair and Maintenance	1.0	34,622	35,864	39,112	3,248	9.1%
8112	Electronic and Precision Equipment Repair and Maintenance	1.1	3,989	4,677	5,137	460	9.8%
8113	Commercial and Industrial Machinery and Equipment (except Automotive and Electronic) Repair and Maintenance	1.0	7,754	8,041	8,924	883	11.0%

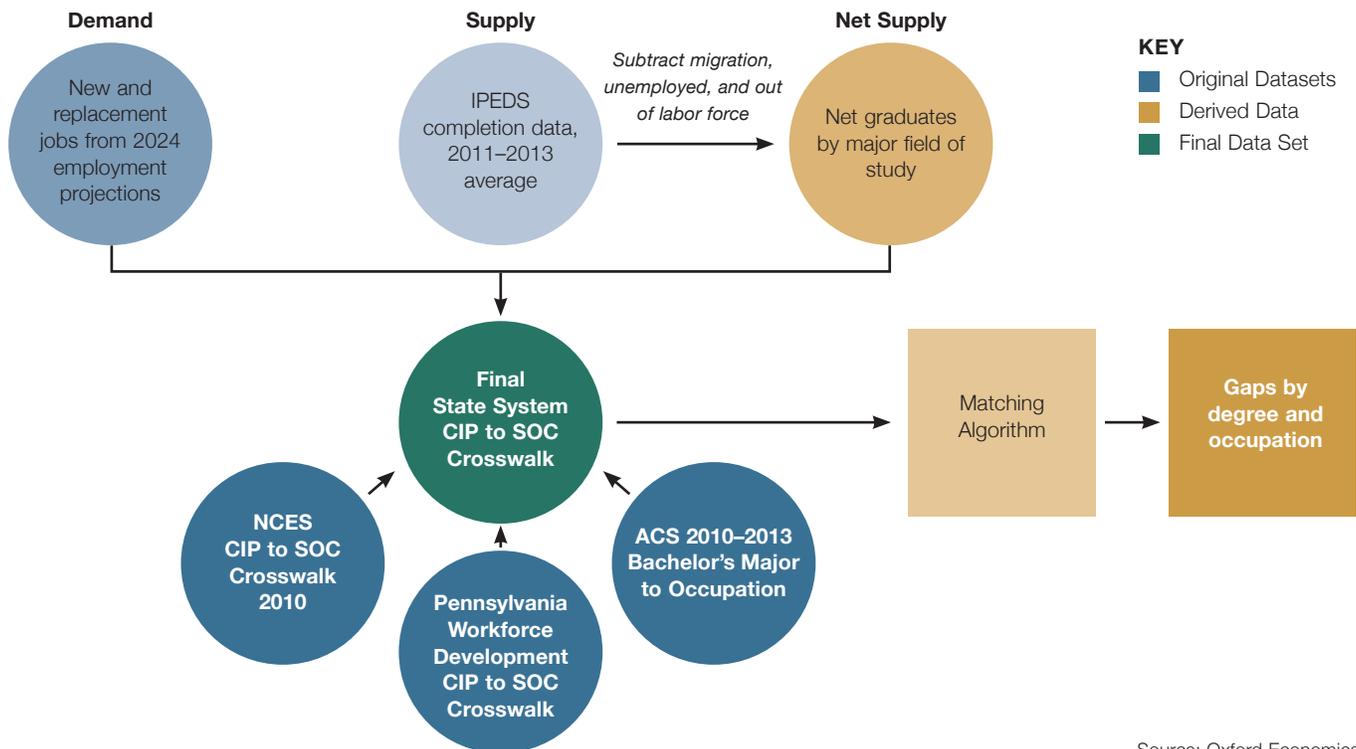
NAICS Code	Industry Title	2014 LQ	2010 Jobs	2014 Jobs	2024 Jobs	Job Change 2014-2024	% Change 2014-2024
8114	Personal and Household Goods Repair and Maintenance	0.7	2,254	2,050	2,062	12	0.6%
8121	Personal Care Services	1.4	33,764	36,613	42,621	6,008	16.4%
8122	Death Care Services	1.3	7,030	7,264	7,946	682	9.4%
8123	Drycleaning and Laundry Services	0.8	10,403	10,132	10,252	120	1.2%
8129	Other Personal Services	0.9	9,609	11,315	13,320	2,005	17.7%
8131	Religious Organizations	1.1	7,871	8,422	8,901	479	5.7%
8132	Grantmaking and Giving Services	1.0	6,100	5,904	6,115	211	3.6%
8133	Social Advocacy Organizations	0.8	6,736	7,260	8,042	782	10.8%
8134	Civic and Social Organizations	2.0	32,045	32,320	34,336	2,016	6.2%
8139	Business, Professional, Labor, Political, and Similar Organizations	1.0	18,757	18,554	19,869	1,315	7.1%
8141	Private Households	0.4	4,513	4,251	4,016	-235	-5.5%
9211	Executive, Legislative, and Other General Government Support	0.9	123,392	116,028	111,895	-4,133	-3.6%
9221	Justice, Public Order, and Safety Activities	0.7	57,433	56,126	54,636	-1,490	-2.7%
9231	Administration of Human Resource Programs	0.5	15,963	15,577	14,996	-581	-3.7%
9241	Administration of Environmental Quality Programs	0.7	9,201	9,512	9,564	52	0.5%
9251	Administration of Housing Programs, Urban Planning, and Community Development	1.6	5,708	5,444	5,219	-225	-4.1%
9261	Administration of Economic Programs	0.5	17,375	11,794	11,257	-537	-4.6%
9281	National Security and International Affairs	0.9	24,565	21,481	19,532	-1,949	-9.1%

Source: BLS (QCEW and OES); Pennsylvania Department of Labor & Industry; Oxford Economics Projections

APPENDIX E: METHODOLOGY

The data-driven process involved in developing this gap analysis required multiple steps including compiling education output and forecasting occupation demand. Broadly speaking, supply-side educational completion data were assembled at the program level for State System Universities as well as other institutions within Pennsylvania. A three-year average was used to mitigate year-to-year variability in completions. A mapping analysis, known as a crosswalk, was developed looking at education programs and occupations and using a combination of the National Center for Education Statistics' (NCES) and US Census American Community Survey (ACS) data. The crosswalk was applied to occupation demand projections, which were produced by Oxford Economics and updated to 2014-2024, to calculate both new and replacement jobs. Linking annual program completions (supply) and annual occupation projections (demand) enabled the calculation of the difference between the two, providing an insight into potential workforce gaps and surpluses for educational institutions to consider. Fig. 38 provides a high-level flow chart of the process to calculate gaps/surpluses

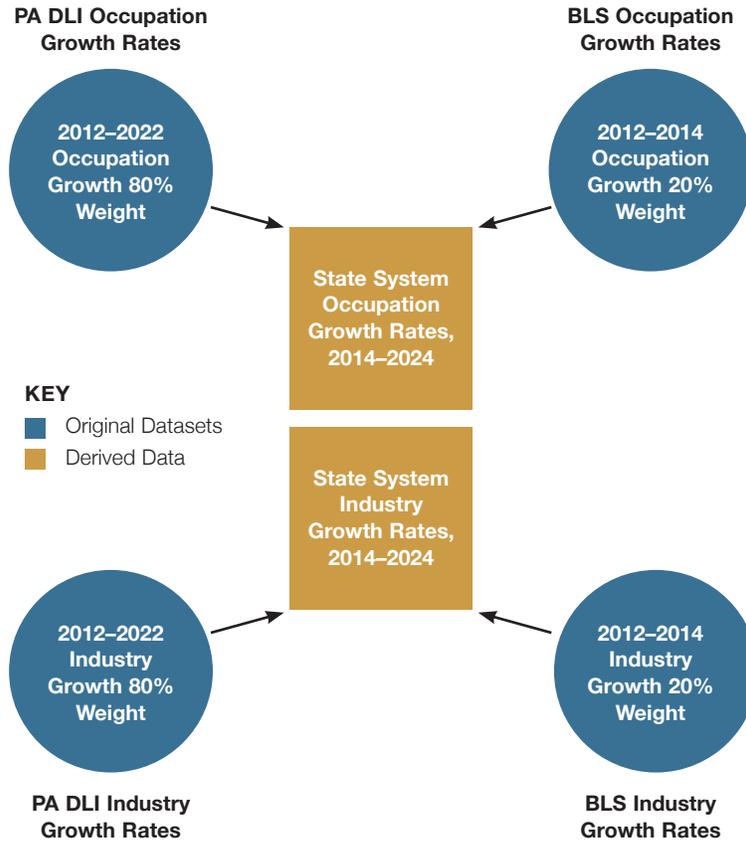
Fig. 38: Summary of Gap Analysis Methodology



Source: Oxford Economics

A primary goal of the research was to produce updated forecasts for industries and occupations at the county level for Pennsylvania. Fig. 39 provides a summary of the growth rate calculations used in the forecasts.

Fig. 39: Summary of Growth Rate Calculations



APPENDIX F: GAP ANALYSIS RESULTS

The following table provides the results of the gap analysis for over 500 detailed occupations. In the tables the following information is provided:

- A description of the occupation – SOC Code and occupation title.
- A description of the level of the occupation – Job Zone.
- Gap indicator with the following color codes:
 - Green = Projected excess employer demand
 - Purple = Projected excess demand at specific degree level
 - Yellow = Projected balance
 - Blue = Projected supply surplus
- Average annual supply, demand, and gap number for each occupation and the detailed degree level supply, demand, and gap number for each occupation.
- The ratio of average annual supply to average annual demand (S/D Ratio).

Occupation Code	Occupation Title	Job Zone	Gap Indicator	Average Annual Demand	Average Annual Supply	Average Annual Gap	S/D Ratio	Associate Demand	Associate Supply	Associate Gap	Bachelor Demand	Bachelor Supply	Bachelor Gap	Graduate Demand	Graduate Supply	Graduate Gap
11-1011	Chief Executives	5		205	260	-55	1.27	0	0	0	174	113	61	31	147	-116
11-1021	General and Operations Managers	4		1,504	1,733	-229	1.15	0	0	0	1,141	701	440	363	1,032	-669
11-1031	Legislators	4		1	1	0	1.00	0	0	0	1	1	0	0	0	0
11-2011	Advertising and Promotions Managers	4		12	27	-15	2.25	0	0	0	10	21	-11	2	6	-4
11-2021	Marketing Managers	4		147	255	-108	1.73	0	0	0	127	196	-69	20	60	-40
11-2022	Sales Managers	4		193	335	-142	1.74	0	0	0	166	257	-91	27	78	-51
11-2031	Public Relations and Fundraising Managers	4		31	85	-54	2.74	0	0	0	18	47	-29	13	38	-25
11-3011	Administrative Services Managers	3		62	38	24	0.61	0	0	0	62	38	24	0	0	0
11-3021	Computer and Information Systems Managers	4		427	589	-162	1.38	0	0	0	261	135	126	166	455	-289
11-3031	Financial Managers	4		211	306	-95	1.45	0	0	0	136	89	47	75	217	-142
11-3051	Industrial Production Managers	4		101	101	0	1.00	0	0	0	85	52	33	16	50	-34
11-3061	Purchasing Managers	4		26	28	-2	1.08	0	0	0	21	13	8	5	15	-10
11-3071	Transportation, Storage, and Distribution Managers	4		59	35	24	0.59	0	0	0	59	35	24	0	0	0
11-3111	Compensation and Benefits Managers	4		11	12	-1	1.09	0	0	0	9	5	4	2	7	-5
11-3121	Human Resources Managers	4		119	199	-80	1.67	0	0	0	61	39	22	57	160	-103
11-3131	Training and Development Managers	4		36	55	-19	1.53	0	0	0	21	13	8	15	42	-27
11-9021	Construction Managers	4		140	80	60	0.57	0	0	0	140	80	60	0	0	0
11-9031	Education Administrators, Preschool and Childcare Center/Program	4		76	202	-126	2.66	0	0	0	22	14	8	53	189	-136
11-9032	Education Administrators, Elementary and Secondary School	5		198	704	-506	3.56	0	0	0	0	0	0	198	704	-506
11-9033	Education Administrators, Postsecondary	5		131	489	-358	3.73	0	0	0	0	0	0	131	489	-358
11-9039	Education Administrators, All Other	5		32	143	-111	4.47	0	0	0	9	6	3	22	137	-115
11-9041	Architectural and Engineering Managers	5		171	316	-145	1.85	0	0	0	95	77	18	77	239	-162
11-9051	Food Service Managers	3		69	364	-295	5.28	23	175	-152	46	190	-144	0	0	0
11-9061	Funeral Service Managers	3		9	6	3	0.67	0	0	0	9	6	3	0	0	0

Occupation Code	Occupation Title	Job Zone	Gap Indicator	Average Annual Demand	Average Annual Supply	Average Annual Gap	S/D Ratio	Associate Demand	Associate Supply	Associate Gap	Bachelor Demand	Bachelor Supply	Bachelor Gap	Graduate Demand	Graduate Supply	Graduate Gap
11-9071	Gaming Managers	3		5	3	2	0.60	0	0	0	5	3	2	0	0	0
11-9081	Lodging Managers	3		39	184	-145	4.72	7	52	-45	32	133	-101	0	0	0
11-9111	Medical and Health Services Managers	5		354	726	-372	2.05	0	0	0	214	180	34	140	546	-406
11-9121	Natural Sciences Managers	5		58	163	-105	2.81	0	0	0	17	91	-74	41	73	-32
11-9131	Postmasters and Mail Superintendents	3		4	2	2	0.50	0	0	0	4	2	2	0	0	0
11-9141	Property, Real Estate, and Community Association Managers	4		81	49	32	0.60	0	0	0	81	49	32	0	0	0
11-9151	Social and Community Service Managers	4		210	458	-248	2.18	0	0	0	112	178	-66	97	280	-183
11-9199	Managers, All Other	4		174	1,038	-864	5.97	0	0	0	136	746	-610	39	292	-253
13-1011	Agents and Business Managers of Artists, Performers, and Athletes	4		2	5	-3	2.50	0	0	0	2	5	-3	0	0	0
13-1021	Buyers and Purchasing Agents, Farm Products	4		13	33	-20	2.54	0	0	0	6	28	-22	7	5	2
13-1022	Wholesale and Retail Buyers, Except Farm Products	3		73	59	14	0.81	0	0	0	73	59	14	0	0	0
13-1023	Purchasing Agents, Except Wholesale, Retail, and Farm Products	4		243	160	83	0.66	0	0	0	193	120	73	50	40	10
13-1031	Claims Adjusters, Examiners, and Investigators	4		361	220	141	0.61	0	0	0	361	220	141	0	0	0
13-1032	Insurance Appraisers, Auto Damage	3		31	19	12	0.61	0	0	0	31	19	12	0	0	0
13-1041	Compliance Officers	4		330	218	112	0.66	0	0	0	242	147	95	88	71	17
13-1051	Cost Estimators	4		324	193	131	0.60	0	0	0	324	193	131	0	0	0
13-1071	Human Resources Specialists	4		684	618	66	0.90	0	0	0	483	306	177	201	312	-111
13-1075	Labor Relations Specialists	4		46	54	-8	1.17	0	0	0	32	21	11	13	34	-21
13-1081	Logisticians	4		138	111	27	0.80	0	0	0	114	67	47	24	44	-20
13-1111	Management Analysts	4		724	1,250	-526	1.73	0	0	0	374	227	147	351	1,023	-672
13-1121	Meeting, Convention, and Event Planners	4		123	290	-167	2.36	0	0	0	102	273	-171	21	17	4
13-1131	Fundraisers	4		134	66	68	0.49	0	0	0	67	48	19	67	17	50
13-1141	Compensation, Benefits, and Job Analysis Specialists	4		49	44	5	0.90	0	0	0	42	26	16	7	18	-11

Occupation Code	Occupation Title	Job Zone	Gap Indicator	Average Annual Demand	Average Annual Supply	Average Annual Gap	S/D Ratio	Associate Demand	Associate Supply	Associate Gap	Bachelor Demand	Bachelor Supply	Bachelor Gap	Graduate Demand	Graduate Supply	Graduate Gap
13-1151	Training and Development Specialists	4		281	239	42	0.85	0	0	0	207	127	80	74	113	-39
13-1161	Market Research Analysts and Marketing Specialists	4		1,127	896	231	0.80	0	0	0	646	527	119	481	369	112
13-1199	Business Operations Specialists, All Other	4		153	119	34	0.78	0	0	0	106	66	40	47	52	-5
13-2011	Accountants and Auditors	4		2,350	1,856	494	0.79	0	0	0	1,881	1,281	600	469	575	-106
13-2021	Appraisers and Assessors of Real Estate	4		16	10	6	0.63	0	0	0	16	10	6	0	0	0
13-2031	Budget Analysts	4		98	87	11	0.89	0	0	0	58	38	20	40	49	-9
13-2041	Credit Analysts	4		97	84	13	0.87	0	0	0	61	40	21	36	44	-8
13-2051	Financial Analysts	4		554	455	99	0.82	0	0	0	395	259	136	159	196	-37
13-2052	Personal Financial Advisors	4		494	371	123	0.75	0	0	0	425	286	139	69	85	-16
13-2053	Insurance Underwriters	4		206	132	74	0.64	0	0	0	206	132	74	0	0	0
13-2061	Financial Examiners	4		64	56	8	0.88	0	0	0	40	27	13	24	29	-5
13-2071	Credit Counselors	4		60	45	15	0.75	0	0	0	48	31	17	12	14	-2
13-2072	Loan Officers	3		258	164	94	0.64	0	0	0	258	164	94	0	0	0
13-2081	Tax Examiners and Collectors, and Revenue Agents	3		55	38	17	0.69	0	0	0	55	38	17	0	0	0
13-2082	Tax Preparers	3		20	23	-3	1.15	5	13	-8	15	10	5	0	0	0
13-2099	Financial Specialists, All Other	4		33	27	6	0.82	0	0	0	24	15	9	10	12	-2
15-1111	Computer and Information Research Scientists	5		1	2	-1	2.00	0	0	0	0	0	0	1	2	-1
15-1121	Computer Systems Analysts	4		1,132	747	385	0.66	0	0	0	857	357	500	275	390	-115
15-1122	Information Security Analysts	4		111	82	29	0.74	0	0	0	76	31	45	34	51	-17
15-1131	Computer Programmers	4		891	543	348	0.61	0	0	0	685	279	406	206	263	-57
15-1132	Software Developers, Applications	4		1,081	811	270	0.75	0	0	0	763	376	387	318	435	-117
15-1133	Software Developers, Systems Software	4		48	41	7	0.85	0	0	0	34	17	17	14	24	-10
15-1134	Web Developers	3		136	54	82	0.40	0	0	0	136	54	82	0	0	0
15-1141	Database Administrators	4		221	156	65	0.71	0	0	0	160	66	94	61	90	-29
15-1142	Network and Computer Systems Administrators	4		124	93	31	0.75	0	0	0	96	44	52	28	49	-21

Occupation Code	Occupation Title	Job Zone	Gap Indicator	Average Annual Demand	Average Annual Supply	Average Annual Gap	S/D Ratio	Associate Demand	Associate Supply	Associate Gap	Bachelor Demand	Bachelor Supply	Bachelor Gap	Graduate Demand	Graduate Supply	Graduate Gap
15-1143	Computer Network Architects	4		104	74	30	0.71	0	0	0	74	30	44	30	44	-14
15-1151	Computer User Support Specialists	3		693	684	9	0.99	185	452	-267	508	232	276	0	0	0
15-1152	Computer Network Support Specialists	4		91	948	-857	10.42	20	899	-879	54	25	29	17	25	-8
15-1199	Computer Occupations, All Other	4		198	149	49	0.75	0	0	0	154	68	86	44	80	-36
15-2011	Actuaries	4		93	154	-61	1.66	0	0	0	53	76	-23	40	78	-38
15-2031	Operations Research Analysts	5		110	104	6	0.95	0	0	0	77	47	30	33	57	-24
15-2041	Statisticians	5		141	229	-88	1.62	0	0	0	0	0	0	141	229	-88
17-1011	Architects, Except Landscape and Naval	4		161	251	-90	1.56	0	0	0	92	108	-16	69	144	-75
17-1012	Landscape Architects	4		54	90	-36	1.67	0	0	0	31	37	-6	23	53	-30
17-1021	Cartographers and Photogrammetrists	4		8	11	-3	1.38	0	0	0	5	9	-4	2	1	1
17-1022	Surveyors	4		68	98	-30	1.44	0	0	0	46	85	-39	22	13	9
17-2011	Aerospace Engineers	4		71	109	-38	1.54	0	0	0	45	27	18	26	82	-56
17-2021	Agricultural Engineers	4		6	7	-1	1.17	0	0	0	4	2	2	2	5	-3
17-2031	Biomedical Engineers	4		26	43	-17	1.65	0	0	0	17	16	1	8	27	-19
17-2041	Chemical Engineers	4		43	69	-26	1.60	0	0	0	30	28	2	12	41	-29
17-2051	Civil Engineers	4		544	466	78	0.86	0	0	0	355	196	159	190	270	-80
17-2061	Computer Hardware Engineers	4		2	1	1	0.50	0	0	0	2	1	1	0	0	0
17-2071	Electrical Engineers	4		257	434	-177	1.69	0	0	0	143	80	63	113	354	-241
17-2072	Electronics Engineers, Except Computer	4		25	42	-17	1.68	0	0	0	14	8	6	11	34	-23
17-2081	Environmental Engineers	5		161	142	19	0.88	0	0	0	100	92	8	61	50	11
17-2111	Health and Safety Engineers, Except Mining Safety Engineers and Inspectors	4		42	29	13	0.69	0	0	0	32	20	12	10	9	1
17-2112	Industrial Engineers	4		296	243	53	0.82	0	0	0	223	139	84	72	104	-32
17-2131	Materials Engineers	4		84	112	-28	1.33	0	0	0	62	39	23	22	73	-51
17-2141	Mechanical Engineers	4		398	438	-40	1.10	0	0	0	326	205	121	72	234	-162
17-2151	Mining and Geological Engineers, Including Mining Safety Engineers	4		9	8	1	0.89	0	0	0	4	3	1	5	5	0
17-2161	Nuclear Engineers	4		90	59	31	0.66	0	0	0	51	19	32	39	40	-1
17-2171	Petroleum Engineers	4		67	58	9	0.87	0	0	0	32	20	12	35	38	-3

Occupation Code	Occupation Title	Job Zone	Gap Indicator	Average Annual Demand	Average Annual Supply	Average Annual Gap	S/D Ratio	Associate Demand	Associate Supply	Associate Gap	Bachelor Demand	Bachelor Supply	Bachelor Gap	Graduate Demand	Graduate Supply	Graduate Gap
17-2199	Engineers, All Other	4		167	273	-106	1.63	0	0	0	95	63	32	72	209	-137
17-3011	Architectural and Civil Drafters	4		115	384	-269	3.34	58	316	-258	58	68	-10	0	0	0
17-3012	Electrical and Electronics Drafters	3		3	46	-43	15.33	1	45	-44	1	1	0	0	0	0
17-3013	Mechanical Drafters	3		32	98	-66	3.06	16	88	-72	16	10	6	0	0	0
17-3019	Drafters, All Other	3		7	25	-18	3.57	3	21	-18	3	4	-1	0	0	0
17-3021	Aerospace Engineering and Operations Technicians	4		1	1	0	1.00	0	0	0	1	1	0	0	0	0
17-3022	Civil Engineering Technicians	3		48	102	-54	2.13	23	75	-52	25	27	-2	0	0	0
17-3023	Electrical and Electronics Engineering Technicians	3		14	225	-211	16.07	7	218	-211	7	7	0	0	0	0
17-3024	Electro-Mechanical Technicians	3		5	81	-76	16.20	2	78	-76	3	3	0	0	0	0
17-3025	Environmental Engineering Technicians	4		27	16	11	0.59	13	4	9	14	12	2	0	0	0
17-3026	Industrial Engineering Technicians	3		23	90	-67	3.91	11	55	-44	12	35	-23	0	0	0
17-3027	Mechanical Engineering Technicians	3		35	79	-44	2.26	16	65	-49	18	14	4	0	0	0
17-3029	Engineering Technicians, Except Drafters, All Other	3		72	216	-144	3.00	34	159	-125	38	57	-19	0	0	0
17-3031	Surveying and Mapping Technicians	3		33	25	8	0.76	33	25	8	0	0	0	0	0	0
19-1012	Food Scientists and Technologists	4		20	43	-23	2.15	0	0	0	10	25	-15	9	18	-9
19-1013	Soil and Plant Scientists	5		10	29	-19	2.90	0	0	0	5	13	-8	5	16	-11
19-1021	Biochemists and Biophysicists	5		129	216	-87	1.67	0	0	0	0	0	0	129	216	-87
19-1022	Microbiologists	5		76	114	-38	1.50	0	0	0	35	46	-11	41	68	-27
19-1023	Zoologists and Wildlife Biologists	5		5	11	-6	2.20	0	0	0	2	5	-3	3	6	-3
19-1029	Biological Scientists, All Other	5		12	129	-117	10.75	0	0	0	6	110	-104	7	19	-12
19-1031	Conservation Scientists	4		23	52	-29	2.26	0	0	0	17	33	-16	6	19	-13
19-1032	Foresters	4		12	27	-15	2.25	0	0	0	9	17	-8	3	10	-7
19-1041	Epidemiologists	5		2	3	-1	1.50	0	0	0	0	0	0	2	3	-1
19-1042	Medical Scientists Except Epidemiologists	5		294	433	-139	1.47	0	0	0	0	0	0	294	433	-139
19-1099	Life Scientists, All Other	5		5	9	-4	1.80	0	0	0	0	0	0	5	9	-4
19-2012	Physicists	5		1	2	-1	2.00	0	0	0	0	0	0	1	2	-1

Occupation Code	Occupation Title	Job Zone	Gap Indicator	Average Annual Demand	Average Annual Supply	Average Annual Gap	S/D Ratio	Associate Demand	Associate Supply	Associate Gap	Bachelor Demand	Bachelor Supply	Bachelor Gap	Graduate Demand	Graduate Supply	Graduate Gap
19-2031	Chemists	4		271	358	-87	1.32	0	0	0	142	185	-43	129	173	-44
19-2032	Materials Scientists	5		13	30	-17	2.31	0	0	0	7	9	-2	6	21	-15
19-2041	Environmental Scientists and Specialists, Including Health	4		171	240	-69	1.40	0	0	0	101	193	-92	70	48	22
19-2042	Geoscientists, Except Hydrologists and Geographers	4		60	109	-49	1.82	0	0	0	36	68	-32	25	41	-16
19-2043	Hydrologists	4		6	9	-3	1.50	0	0	0	0	0	0	6	9	-3
19-3011	Economists	5		26	39	-13	1.50	0	0	0	0	0	0	26	39	-13
19-3022	Survey Researchers	5		96	130	-34	1.35	0	0	0	0	0	0	96	130	-34
19-3031	Clinical, Counseling, and School Psychologists	5		186	921	-735	4.95	0	0	0	0	0	0	186	921	-735
19-3039	Psychologists, All Other	5		19	93	-74	4.89	0	0	0	0	0	0	19	93	-74
19-3041	Sociologists	5		4	31	-27	7.75	0	0	0	0	0	0	4	31	-27
19-3051	Urban and Regional Planners	5		85	91	-6	1.07	0	0	0	0	0	0	85	91	-6
19-3091	Anthropologists and Archeologists	5		2	11	-9	5.50	0	0	0	0	0	0	2	11	-9
19-3099	Social Scientists and Related Workers, All Other	4		9	120	-111	13.33	0	0	0	3	61	-58	6	59	-53
19-4011	Agricultural and Food Science Technicians	3		3	9	-6	3.00	0	0	0	3	9	-6	0	0	0
19-4021	Biological Technicians	4		209	263	-54	1.26	0	0	0	209	263	-54	0	0	0
19-4031	Chemical Technicians	3		147	103	44	0.70	0	0	0	147	103	44	0	0	0
19-4041	Geological and Petroleum Technicians	4		40	23	17	0.58	15	23	-8	25	0	25	0	0	0
19-4051	Nuclear Technicians	3		16	19	-3	1.19	16	19	-3	0	0	0	0	0	0
19-4061	Social Science Research Assistants	4		46	49	-3	1.07	0	0	0	37	42	-5	10	7	3
19-4091	Environmental Science and Protection Technicians, Including Health	4		104	144	-40	1.38	0	0	0	83	129	-46	22	15	7
19-4092	Forensic Science Technicians	4		6	16	-10	2.67	0	0	0	5	6	-1	1	10	-9
19-4093	Forest and Conservation Technicians	3		14	19	-5	1.36	0	0	0	14	19	-5	0	0	0
19-4099	Life, Physical, and Social Science Technicians, All Other	3		70	89	-19	1.27	0	0	0	70	89	-19	0	0	0
21-1011	Substance Abuse and Behavioral Disorder Counselors	5		164	180	-16	1.10	0	0	0	61	97	-36	103	83	20

Occupation Code	Occupation Title	Job Zone	Gap Indicator	Average Annual Demand	Average Annual Supply	Average Annual Gap	S/D Ratio	Associate Demand	Associate Supply	Associate Gap	Bachelor Demand	Bachelor Supply	Bachelor Gap	Graduate Demand	Graduate Supply	Graduate Gap
21-1012	Educational, Guidance, School, and Vocational Counselors	5		236	511	-275	2.17	0	0	0	0	0	0	236	511	-275
21-1013	Marriage and Family Therapists	5		49	98	-49	2.00	0	0	0	0	0	0	49	98	-49
21-1014	Mental Health Counselors	5		308	248	60	0.81	0	0	0	0	0	0	308	248	60
21-1015	Rehabilitation Counselors	5		318	258	60	0.81	0	0	0	0	0	0	318	258	60
21-1019	Counselors, All Other	5		20	43	-23	2.15	0	0	0	0	0	0	20	43	-23
21-1021	Child, Family, and School Social Workers	4		554	750	-196	1.35	0	0	0	369	601	-232	184	149	35
21-1022	Healthcare Social Workers	5		368	296	72	0.80	0	0	0	0	0	0	368	296	72
21-1023	Mental Health and Substance Abuse Social Workers	5		446	604	-158	1.35	0	0	0	298	485	-187	149	120	29
21-1029	Social Workers, All Other	5		26	42	-16	1.62	0	0	0	18	29	-11	9	12	-3
21-1091	Health Educators	4		81	167	-86	2.06	0	0	0	53	79	-26	28	88	-60
21-1092	Probation Officers and Correctional Treatment Specialists	4		128	220	-92	1.72	0	0	0	89	188	-99	39	32	7
21-1093	Social and Human Service Assistants	4		571	894	-323	1.57	96	240	-144	366	575	-209	109	80	29
21-1094	Community Health Workers	4		27	56	-29	2.07	0	0	0	18	26	-8	9	29	-20
21-1099	Community and Social Service Specialists, All Other	4		36	61	-25	1.69	0	0	0	0	0	0	36	61	-25
21-2011	Clergy	5		72	462	-390	6.42	0	0	0	32	156	-124	40	306	-266
21-2021	Directors, Religious Activities and Education	4		99	287	-188	2.90	0	0	0	70	152	-82	28	135	-107
21-2099	Religious Workers, All Other	4		2	9	-7	4.50	0	0	0	2	9	-7	0	0	0
23-1011	Lawyers	5		665	1,527	-862	2.30	0	0	0	0	0	0	665	1,527	-862
23-1012	Judicial Law Clerks	5		28	65	-37	2.32	0	0	0	0	0	0	28	65	-37
23-1021	Administrative Law Judges, Adjudicators, and Hearing Officers	5		8	19	-11	2.38	0	0	0	0	0	0	8	19	-11
23-1022	Arbitrators, Mediators, and Conciliators	5		13	29	-16	2.23	0	0	0	0	0	0	13	29	-16
23-1023	Judges, Magistrate Judges, and Magistrates	5		2	6	-4	3.00	0	0	0	0	0	0	2	6	-4
23-2011	Paralegals and Legal Assistants	3		290	638	-348	2.20	43	275	-232	246	363	-117	0	0	0
23-2091	Court Reporters	3		17	40	-23	2.35	3	19	-16	14	20	-6	0	0	0

Occupation Code	Occupation Title	Job Zone	Gap Indicator	Average Annual		S/D Ratio	Associate		Bachelor		Graduate	
				Demand	Supply		Demand	Supply	Demand	Supply	Demand	Supply
23-2093	Title Examiners, Abstractors, and Searchers	3		58	137	2.36	11	67	47	70	0	0
23-2099	Legal Support Workers, All Other	3		6	15	2.50	1	7	5	8	0	0
25-1011	Business Teachers, Postsecondary	5		161	426	2.65	0	0	0	0	161	-265
25-1021	Computer Science Teachers, Postsecondary	5		73	130	1.78	0	0	0	0	73	-57
25-1022	Mathematical Science Teachers, Postsecondary	5		68	111	1.63	0	0	0	0	68	-43
25-1031	Architecture Teachers, Postsecondary	5		20	43	2.15	0	0	0	0	20	-23
25-1032	Engineering Teachers, Postsecondary	5		106	333	3.14	0	0	0	0	106	-227
25-1041	Agricultural Sciences Teachers, Postsecondary	5		1	14	14.00	0	0	0	0	1	-13
25-1042	Biological Science Teachers, Postsecondary	5		85	154	1.81	0	0	0	0	85	-69
25-1051	Atmospheric, Earth, Marine, and Space Sciences Teachers, Postsecondary	5		25	43	1.72	0	0	0	0	25	-18
25-1052	Chemistry Teachers, Postsecondary	5		47	75	1.60	0	0	0	0	47	-28
25-1053	Environmental Science Teachers, Postsecondary	5		5	8	1.60	0	0	0	0	5	-3
25-1054	Physics Teachers, Postsecondary	5		37	63	1.70	0	0	0	0	37	-26
25-1061	Anthropology and Archeology Teachers, Postsecondary	5		6	35	5.83	0	0	0	0	6	-29
25-1062	Area, Ethnic, and Cultural Studies Teachers, Postsecondary	5		12	67	5.58	0	0	0	0	12	-55
25-1063	Economics Teachers, Postsecondary	5		37	61	1.65	0	0	0	0	37	-24
25-1064	Geography Teachers, Postsecondary	5		10	56	5.60	0	0	0	0	10	-46
25-1065	Political Science Teachers, Postsecondary	5		31	193	6.23	0	0	0	0	31	-162
25-1066	Psychology Teachers, Postsecondary	5		62	302	4.87	0	0	0	0	62	-240
25-1067	Sociology Teachers, Postsecondary	5		56	102	1.82	0	0	0	0	56	-46
25-1069	Social Sciences Teachers, Postsecondary, All Other	5		19	32	1.68	0	0	0	0	19	-13

Occupation Code	Occupation Title	Job Zone	Gap Indicator	Average Annual Demand	Average Annual Supply	Average Annual Gap	S/D Ratio	Associate Demand	Associate Supply	Associate Gap	Bachelor Demand	Bachelor Supply	Bachelor Gap	Graduate Demand	Graduate Supply	Graduate Gap
25-1071	Health Specialties Teachers, Postsecondary	5		139	364	-225	2.62	0	0	0	0	0	0	139	364	-225
25-1072	Nursing Instructors and Teachers, Postsecondary	5		55	524	-469	9.53	0	0	0	0	0	0	55	524	-469
25-1081	Education Teachers, Postsecondary	5		67	108	-41	1.61	0	0	0	0	0	0	67	108	-41
25-1082	Library Science Teachers, Postsecondary	5		12	53	-41	4.42	0	0	0	0	0	0	12	53	-41
25-1111	Criminal Justice and Law Enforcement Teachers, Postsecondary	5		12	102	-90	8.50	0	0	0	0	0	0	12	102	-90
25-1112	Law Teachers, Postsecondary	5		16	37	-21	2.31	0	0	0	0	0	0	16	37	-21
25-1113	Social Work Teachers, Postsecondary	5		7	10	-3	1.43	0	0	0	0	0	0	7	10	-3
25-1121	Art, Drama, and Music Teachers, Postsecondary	5		201	462	-261	2.30	0	0	0	0	0	0	201	462	-261
25-1122	Communications Teachers, Postsecondary	5		49	143	-94	2.92	0	0	0	0	0	0	49	143	-94
25-1123	English Language and Literature Teachers, Postsecondary	5		81	213	-132	2.63	0	0	0	0	0	0	81	213	-132
25-1124	Foreign Language and Literature Teachers, Postsecondary	5		54	114	-60	2.11	0	0	0	0	0	0	54	114	-60
25-1125	History Teachers, Postsecondary	5		41	69	-28	1.68	0	0	0	0	0	0	41	69	-28
25-1126	Philosophy and Religion Teachers, Postsecondary	5		39	306	-267	7.85	0	0	0	0	0	0	39	306	-267
25-1191	Graduate Teaching Assistants	5		50	60	-10	1.20	0	0	0	20	10	10	30	50	-20
25-1193	Recreation and Fitness Studies Teachers, Postsecondary	5		17	127	-110	7.47	0	0	0	0	0	0	17	127	-110
25-1194	Vocational Education Teachers, Postsecondary	3		50	24	26	0.48	0	0	0	50	24	26	0	0	0
25-1199	Postsecondary Teachers, All Other	5		160	692	-532	4.33	0	0	0	0	0	0	160	692	-532
25-2011	Preschool Teachers, Except Special Education	3		457	672	-215	1.47	101	437	-336	356	235	121	0	0	0
25-2012	Kindergarten Teachers, Except Special Education	4		113	127	-14	1.12	0	0	0	82	81	1	31	46	-15
25-2021	Elementary School Teachers, Except Special Education	4		1,245	1,811	-566	1.45	0	0	0	404	539	-135	841	1,272	-431
25-2022	Middle School Teachers, Except Special and Career/Technical Education	4		897	1,356	-459	1.51	0	0	0	291	389	-98	606	968	-362

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25-2023	Career/Technical Education Teachers, Middle School	4		29	45	-16	1.55	0	0	0	9	12	-3	19	33	-14
25-2031	Secondary School Teachers, Except Special and Career/Technical Education	4		1,412	2,296	-884	1.63	0	0	0	470	765	-295	942	1,532	-590
25-2032	Career/Technical Education Teachers, Secondary School	4		96	154	-58	1.60	0	0	0	32	46	-14	64	109	-45
25-2051	Special Education Teachers, Preschool	4		24	41	-17	1.71	0	0	0	6	6	0	17	34	-17
25-2052	Special Education Teachers, Kindergarten and Elementary School	4		265	456	-191	1.72	0	0	0	70	72	-2	196	385	-189
25-2053	Special Education Teachers, Middle School	4		81	138	-57	1.70	0	0	0	21	20	1	60	118	-58
25-2054	Special Education Teachers, Secondary School	4		207	351	-144	1.70	0	0	0	55	50	5	153	300	-147
25-2059	Special Education Teachers, All Other	4		7	13	-6	1.86	0	0	0	2	2	0	6	11	-5
25-3011	Adult Basic and Secondary Education and Literacy Teachers and Instructors	4		13	65	-52	5.00	0	0	0	9	7	2	4	57	-53
25-3021	Self-Enrichment Education Teachers	3		74	59	15	0.80	0	0	0	74	59	15	0	0	0
25-3097	Teachers and Instructors, All Other, Except Substitute Teachers	3		135	76	59	0.56	0	0	0	95	76	19	40	0	40
25-3098	Substitute Teachers	3		117	472	-355	4.03	0	0	0	82	65	17	35	407	-372
25-4011	Archivists	5		13	28	-15	2.15	0	0	0	0	0	0	13	28	-15
25-4012	Curators	5		24	41	-17	1.71	0	0	0	0	0	0	24	41	-17
25-4013	Museum Technicians and Conservators	4		30	51	-21	1.70	0	0	0	6	12	-6	24	39	-15
25-4021	Librarians	5		133	579	-446	4.35	0	0	0	0	0	0	133	579	-446
25-4031	Library Technicians	4		98	180	-82	1.84	0	0	0	66	176	-110	33	3	30
25-9011	Audio-Visual and Multimedia Collections Specialists	4		5	50	-45	10.00	0	0	0	1	1	0	4	50	-46
25-9031	Instructional Coordinators	5		48	585	-537	12.19	0	0	0	0	0	0	48	585	-537
25-9041	Teacher Assistants	3		510	606	-96	1.19	141	212	-71	369	394	-25	0	0	0
25-9099	Education, Training, and Library Workers, All Other	4		7	26	-19	3.71	0	0	0	2	2	0	5	24	-19
27-1011	Art Directors	4		44	119	-75	2.70	0	0	0	35	97	-62	9	22	-13

Occupation Code	Occupation Title	Job Zone	Gap Indicator	Average Annual		S/D Ratio	Associate		Bachelor		Graduate	
				Demand	Supply		Demand	Supply	Demand	Supply	Demand	Supply
27-1013	Fine Artists, Including Painters, Sculptors, and Illustrators	3		6	18	3.00	0	0	6	18	0	0
27-1014	Multimedia Artists and Animators	4		16	50	3.13	0	0	13	41	3	-5
27-1021	Commercial and Industrial Designers	4		1	4	4.00	0	0	1	4	0	0
27-1022	Fashion Designers	3		4	12	3.00	0	0	4	12	0	0
27-1024	Graphic Designers	4		294	817	2.78	0	0	294	817	0	0
27-1025	Interior Designers	4		88	247	2.81	0	0	88	247	0	0
27-1026	Merchandise Displayers and Window Trimmers	3		117	329	2.81	0	0	117	329	0	0
27-1027	Set and Exhibit Designers	5		12	35	2.92	0	0	12	35	0	0
27-2012	Producers and Directors	4		140	567	4.05	0	0	140	567	0	0
27-2022	Coaches and Scouts	4		137	511	3.73	0	0	86	125	52	-333
27-2023	Umpires, Referees, and Other Sports Officials	3		3	5	1.67	0	0	3	5	0	0
27-2032	Choreographers	4		9	27	3.00	0	0	9	27	0	0
27-2041	Music Directors and Composers	3		5	10	2.00	0	0	3	5	2	-4
27-2042	Musicians and Singers	3		11	19	1.73	0	0	11	19	0	0
27-3011	Radio and Television Announcers	3		30	99	3.30	0	0	30	99	0	0
27-3022	Reporters and Correspondents	4		35	118	3.37	0	0	23	82	11	-25
27-3031	Public Relations Specialists	4		127	406	3.20	0	0	108	345	19	-42
27-3041	Editors	4		67	322	4.81	0	0	56	291	11	-21
27-3042	Technical Writers	4		36	90	2.50	0	0	25	60	10	-21
27-3043	Writers and Authors	4		36	163	4.53	0	0	24	127	12	-24
27-3091	Interpreters and Translators	4		8	13	1.63	0	0	5	7	3	-3
27-4011	Audio and Video Equipment Technicians	3		37	128	3.46	7	50	29	78	0	0
27-4012	Broadcast Technicians	3		14	48	3.43	3	19	11	30	0	0
27-4014	Sound Engineering Technicians	3		3	8	2.67	0	0	3	8	0	0
27-4021	Photographers	3		21	380	18.10	5	311	16	70	0	0
27-4031	Camera Operators, Television, Video, and Motion Picture	3		3	11	3.67	0	0	3	11	0	0
29-1011	Chiropractors	5		81	27	0.33	0	0	0	0	81	27

Occupation Code	Occupation Title	Job Zone	Gap Indicator	Average Annual Demand	Average Annual Supply	Average Annual Gap	S/D Ratio	Associate Demand	Associate Supply	Associate Gap	Bachelor Demand	Bachelor Supply	Bachelor Gap	Graduate Demand	Graduate Supply	Graduate Gap
29-1021	Dentists, General	5		139	276	-137	1.99	0	0	0	0	0	0	139	276	-137
29-1022	Oral and Maxillofacial Surgeons	5		4	8	-4	2.00	0	0	0	0	0	0	4	8	-4
29-1023	Orthodontists	5		5	9	-4	1.80	0	0	0	0	0	0	5	9	-4
29-1029	Dentists, All Other Specialists	5		2	14	-12	7.00	0	0	0	0	0	0	2	14	-12
29-1031	Dietitians and Nutritionists	5		61	101	-40	1.66	0	0	0	29	46	-17	33	54	-21
29-1041	Optometrists	5		89	140	-51	1.57	0	0	0	0	0	0	89	140	-51
29-1051	Pharmacists	5		429	833	-404	1.94	0	0	0	0	0	0	429	833	-404
29-1061	Anesthesiologists	5		52	86	-34	1.65	0	0	0	0	0	0	52	86	-34
29-1062	Family and General Practitioners	5		237	386	-149	1.63	0	0	0	0	0	0	237	386	-149
29-1063	Internists, General	5		18	30	-12	1.67	0	0	0	0	0	0	18	30	-12
29-1064	Obstetricians and Gynecologists	5		16	26	-10	1.63	0	0	0	0	0	0	16	26	-10
29-1065	Pediatricians, General	5		16	27	-11	1.69	0	0	0	0	0	0	16	27	-11
29-1066	Psychiatrists	5		26	43	-17	1.65	0	0	0	0	0	0	26	43	-17
29-1067	Surgeons	5		115	190	-75	1.65	0	0	0	0	0	0	115	190	-75
29-1069	Physicians and Surgeons, All Other	5		516	840	-324	1.63	0	0	0	0	0	0	516	840	-324
29-1071	Physician Assistants	5		162	455	-293	2.81	0	0	0	0	0	0	162	455	-293
29-1081	Podiatrists	5		41	93	-52	2.27	0	0	0	0	0	0	41	93	-52
29-1122	Occupational Therapists	5		319	426	-107	1.34	0	0	0	0	0	0	319	426	-107
29-1123	Physical Therapists	5		688	739	-51	1.07	0	0	0	0	0	0	688	739	-51
29-1124	Radiation Therapists	3		11	14	-3	1.27	3	6	-3	8	8	0	0	0	0
29-1125	Recreational Therapists	4		38	30	8	0.79	0	0	0	38	30	8	0	0	0
29-1126	Respiratory Therapists	3		175	199	-24	1.14	131	165	-34	44	33	11	0	0	0
29-1127	Speech-Language Pathologists	5		239	340	-101	1.42	0	0	0	0	0	0	239	340	-101
29-1128	Exercise Physiologists	5		14	18	-4	1.29	0	0	0	4	6	-2	10	11	-1
29-1129	Therapists, All Other	4		21	41	-20	1.95	0	0	0	6	5	1	14	36	-22
29-1131	Veterinarians	5		191	118	73	0.62	0	0	0	0	0	0	191	118	73
29-1141	Registered Nurses	3		5,211	4,587	624	0.88	2,322	2,312	10	2,889	2,275	614	0	0	0
29-1151	Nurse Anesthetists	5		65	197	-132	3.03	0	0	0	0	0	0	65	197	-132
29-1161	Nurse Midwives	5		8	24	-16	3.00	0	0	0	0	0	0	8	24	-16
29-1171	Nurse Practitioners	5		190	531	-341	2.79	0	0	0	0	0	0	190	531	-341
29-1181	Audiologists	5		26	40	-14	1.54	0	0	0	0	0	0	26	40	-14

Occupation Code	Occupation Title	Job Zone	Gap Indicator	Average Annual Demand	Average Annual Supply	Average Annual Gap	S/D Ratio	Associate Demand	Associate Supply	Associate Gap	Bachelor Demand	Bachelor Supply	Bachelor Gap	Graduate Demand	Graduate Supply	Graduate Gap
29-1199	Health Diagnosing and Treating Practitioners, All Other	5		5	11	-6	2.20	0	0	0	0	0	0	5	11	-6
29-2011	Medical and Clinical Laboratory Technologists	4		261	52	209	0.20	0	0	0	220	34	186	42	17	25
29-2012	Medical and Clinical Laboratory Technicians	3		263	142	121	0.54	80	113	-33	183	29	154	0	0	0
29-2021	Dental Hygienists	3		455	191	264	0.42	334	174	160	121	17	104	0	0	0
29-2031	Cardiovascular Technologists and Technicians	3		91	45	46	0.49	60	40	20	32	5	27	0	0	0
29-2032	Diagnostic Medical Sonographers	3		64	142	-78	2.22	41	98	-57	22	43	-21	0	0	0
29-2033	Nuclear Medicine Technologists	3		17	33	-16	1.94	11	12	-1	6	21	-15	0	0	0
29-2034	Radiologic Technologists	3		224	390	-166	1.74	146	316	-170	78	74	4	0	0	0
29-2035	Magnetic Resonance Imaging Technologists	3		46	11	35	0.24	30	9	21	16	3	13	0	0	0
29-2041	Emergency Medical Technicians and Paramedics	3		210	159	51	0.76	100	74	26	109	85	24	0	0	0
29-2052	Pharmacy Technicians	3		154	47	107	0.31	78	35	43	76	12	64	0	0	0
29-2053	Psychiatric Technicians	3		22	35	-13	1.59	11	33	-22	11	2	9	0	0	0
29-2055	Surgical Technologists	3		62	194	-132	3.13	31	189	-158	31	5	26	0	0	0
29-2056	Veterinary Technologists and Technicians	3		90	221	-131	2.46	45	175	-130	44	46	-2	0	0	0
29-2057	Ophthalmic Medical Technicians	3		24	5	19	0.21	12	4	8	12	2	10	0	0	0
29-2061	Licensed Practical and Licensed Vocational Nurses	3		450	104	346	0.23	450	104	346	0	0	0	0	0	0
29-2071	Medical Records and Health Information Technicians	3		127	203	-76	1.60	47	145	-98	80	58	22	0	0	0
29-2081	Opticians, Dispensing	3		114	25	89	0.22	51	15	36	62	10	52	0	0	0
29-2091	Orthotists and Prosthetists	5		5	11	-6	2.20	0	0	0	0	0	0	5	11	-6
29-2099	Health Technologists and Technicians, All Other	3		28	96	-68	3.43	11	75	-64	17	21	-4	0	0	0
29-9011	Occupational Health and Safety Specialists	4		80	155	-75	1.94	0	0	0	54	81	-27	25	74	-49
29-9012	Occupational Health and Safety Technicians	3		14	20	-6	1.43	0	0	0	14	20	-6	0	0	0
29-9091	Athletic Trainers	5		70	236	-166	3.37	0	0	0	48	186	-138	22	51	-29

Occupation Code	Occupation Title	Job Zone	Gap Indicator	Average Annual Demand	Average Annual Supply	Average Annual Gap	S/D Ratio	Associate Demand	Associate Supply	Associate Gap	Bachelor Demand	Bachelor Supply	Bachelor Gap	Graduate Demand	Graduate Supply	Graduate Gap
29-9099	Healthcare Practitioners and Technical Workers, All Other	4		1	2	-1	2.00	0	0	0	1	2	-1	0	0	0
31-2011	Occupational Therapy Assistants	3		170	206	-36	1.21	118	131	-13	52	76	-24	0	0	0
31-2012	Occupational Therapy Aides	3		48	58	-10	1.21	33	37	-4	14	21	-7	0	0	0
31-2021	Physical Therapist Assistants	3		275	367	-92	1.33	151	270	-119	124	97	27	0	0	0
31-9011	Massage Therapists	3		61	89	-28	1.46	23	83	-60	38	6	32	0	0	0
31-9091	Dental Assistants	3		125	105	20	0.84	69	96	-27	56	9	47	0	0	0
31-9092	Medical Assistants	3		356	1,036	-680	2.91	356	1,036	-680	0	0	0	0	0	0
31-9094	Medical Transcriptionists	3		23	21	2	0.91	6	12	-6	17	9	8	0	0	0
31-9096	Veterinary Assistants and Laboratory Animal Caretakers	3		28	82	-54	2.93	18	70	-52	10	12	-2	0	0	0
31-9097	Phlebotomists	3		74	133	-59	1.80	74	133	-59	0	0	0	0	0	0
33-1011	First-Line Supervisors of Correctional Officers	3		20	63	-43	3.15	10	41	-31	10	22	-12	0	0	0
33-1012	First-Line Supervisors of Police and Detectives	3		86	247	-161	2.87	32	133	-101	54	114	-60	0	0	0
33-1021	First-Line Supervisors of Fire Fighting and Prevention Workers	3		20	30	-10	1.50	11	11	0	9	20	-11	0	0	0
33-1099	First-Line Supervisors of Protective Service Workers, All Other	3		63	114	-51	1.81	18	20	-2	45	95	-50	0	0	0
33-2011	Firefighters	3		64	108	-44	1.69	23	21	2	41	87	-46	0	0	0
33-2021	Fire Inspectors and Investigators	3		3	2	1	0.67	3	2	1	0	0	0	0	0	0
33-3012	Correctional Officers and Jailers	3		125	385	-260	3.08	62	252	-190	63	134	-71	0	0	0
33-3021	Detectives and Criminal Investigators	3		51	165	-114	3.24	0	0	0	41	88	-47	9	77	-68
33-3051	Police and Sheriff's Patrol Officers	3		501	1,424	-923	2.84	179	738	-559	323	686	-363	0	0	0
33-9021	Private Detectives and Investigators	3		24	60	-36	2.50	4	17	-13	20	42	-22	0	0	0
35-1011	Chefs and Head Cooks	3		44	437	-393	9.93	23	370	-347	21	66	-45	0	0	0
37-1012	First-Line Supervisors of Landscaping, Lawn Service, and Groundskeeping Workers	3		17	41	-24	2.41	0	0	0	17	41	-24	0	0	0
39-1021	First-Line Supervisors of Personal Service Workers	3		199	94	105	0.47	55	6	49	144	87	57	0	0	0

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39-4031	Morticians, Undertakers, and Funeral Directors	3		70	54	16	0.77	23	48	-25	47	7	40	0	0	0
39-5011	Barbers	3		5	4	1	0.80	0	0	0	5	4	1	0	0	0
39-5012	Hairdressers, Hairstylists, and Cosmetologists	3		184	29	155	0.16	184	29	155	0	0	0	0	0	0
39-5094	Skincare Specialists	3		2	0	2	0.00	2	0	2	0	0	0	0	0	0
39-6012	Concierges	3		5	3	2	0.60	0	0	0	5	3	2	0	0	0
39-7011	Tour Guides and Escorts	3		34	21	13	0.62	0	0	0	34	21	13	0	0	0
39-7012	Travel Guides	3		1	1	0	1.00	0	0	0	1	1	0	0	0	0
39-9011	Childcare Workers	3		159	170	-11	1.07	0	0	0	159	170	-11	0	0	0
39-9031	Fitness Trainers and Aerobics Instructors	3		259	380	-121	1.47	0	0	0	259	380	-121	0	0	0
39-9032	Recreation Workers	4		315	463	-148	1.47	0	0	0	315	463	-148	0	0	0
39-9041	Residential Advisors	3		179	285	-106	1.59	0	0	0	179	285	-106	0	0	0
41-1012	First-Line Supervisors of Non-Retail Sales Workers	4		35	47	-12	1.34	8	28	-20	27	19	8	0	0	0
41-3011	Advertising Sales Agents	3		146	353	-207	2.42	0	0	0	146	353	-207	0	0	0
41-3021	Insurance Sales Agents	4		431	216	215	0.50	80	3	77	351	213	138	0	0	0
41-3031	Securities, Commodities, and Financial Services Sales Agents	4		350	264	86	0.75	0	0	0	298	201	97	51	62	-11
41-3041	Travel Agents	3		69	49	20	0.71	33	26	7	37	23	14	0	0	0
41-3099	Sales Representatives, Services, All Other	4		1,110	671	439	0.60	192	56	136	725	565	160	192	50	142
41-4011	Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Products	4		58	45	13	0.78	0	0	0	58	45	13	0	0	0
41-4012	Sales Representatives, Wholesale and Manufacturing, Except Technical and Scientific Products	4		706	557	149	0.79	0	0	0	706	557	149	0	0	0
41-9021	Real Estate Brokers	4		1	1	0	1.00	0	0	0	1	1	0	0	0	0
41-9022	Real Estate Sales Agents	3		118	67	51	0.57	21	7	14	97	60	37	0	0	0
41-9031	Sales Engineers	4		65	43	22	0.66	0	0	0	65	43	22	0	0	0
41-9099	Sales and Related Workers, All Other	3		8	5	3	0.63	0	0	0	8	5	3	0	0	0
43-1011	First-Line Supervisors of Office and Administrative Support Workers	3		819	1,638	-819	2.00	213	1,270	-1,057	606	368	238	0	0	0
43-3031	Bookkeeping, Accounting, and Auditing Clerks	3		536	640	-104	1.19	169	397	-228	367	243	124	0	0	0

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43-3061	Procurement Clerks	3		32	27	5	0.84	10	13	-3	22	13	9	0	0	0
43-4011	Brokerage Clerks	3		91	59	32	0.65	0	0	0	91	59	32	0	0	0
43-4031	Court, Municipal, and License Clerks	3		33	50	-17	1.52	9	13	-4	23	37	-14	0	0	0
43-4061	Eligibility Interviewers, Government Programs	3		101	160	-59	1.58	0	0	0	101	160	-59	0	0	0
43-4131	Loan Interviewers and Clerks	3		95	87	8	0.92	38	52	-14	57	35	22	0	0	0
43-4161	Human Resources Assistants, Except Payroll and Timekeeping	3		73	81	-8	1.11	15	45	-30	58	36	22	0	0	0
43-5061	Production, Planning, and Expediting Clerks	3		280	213	67	0.76	56	76	-20	224	137	87	0	0	0
43-6011	Executive Secretaries and Executive Administrative Assistants	3		121	133	-12	1.10	36	74	-38	84	59	25	0	0	0
43-6012	Legal Secretaries	3		181	163	18	0.90	54	75	-21	126	88	38	0	0	0
43-6013	Medical Secretaries	3		440	499	-59	1.13	132	285	-153	308	214	94	0	0	0
43-6014	Secretaries and Administrative Assistants, Except Legal, Medical, and Executive	3		1,378	1,237	141	0.90	414	567	-153	963	670	293	0	0	0
43-9011	Computer Operators	3		31	30	1	0.97	13	20	-7	18	10	8	0	0	0
43-9031	Desktop Publishers	3		9	85	-76	9.44	2	67	-65	7	18	-11	0	0	0
43-9041	Insurance Claims and Policy Processing Clerks	3		248	212	36	0.85	80	110	-30	168	102	66	0	0	0
43-9081	Proofreaders and Copy Markers	4		4	3	1	0.75	0	0	0	4	3	1	0	0	0
43-9111	Statistical Assistants	4		18	18	0	1.00	0	0	0	11	7	4	7	12	-5
43-9199	Office and Administrative Support Workers, All Other	3		141	109	32	0.77	30	41	-11	111	68	43	0	0	0
45-1011	First-Line Supervisors of Farming, Fishing, and Forestry Workers	3		7	19	-12	2.71	0	0	0	7	19	-12	0	0	0
45-4011	Forest and Conservation Workers	3		2	10	-8	5.00	0	0	0	2	10	-8	0	0	0
47-1011	First-Line Supervisors of Construction Trades and Extraction Workers	3		142	85	57	0.60	0	0	0	142	85	57	0	0	0
47-2011	Boilermakers	3		13	3	10	0.23	13	3	10	0	0	0	0	0	0
47-2111	Electricians	3		283	339	-56	1.20	283	339	-56	0	0	0	0	0	0
47-2162	Plumbers, Pipefitters, and Steamfitters	3		65	15	50	0.23	65	15	50	0	0	0	0	0	0
47-4011	Construction and Building Inspectors	3		178	83	95	0.47	60	18	42	118	65	53	0	0	0

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49-1011	First-Line Supervisors of Mechanics, Installers, and Repairers	3		274	138	136	0.50	68	14	54	205	124	81	0	0	0
49-2011	Computer, Automated Teller, and Office Machine Repairers	3		42	40	2	0.95	42	40	2	0	0	0	0	0	0
49-2022	Telecommunications Equipment Installers and Repairers, Except Line Installers	3		44	33	11	0.75	23	22	1	21	12	9	0	0	0
49-2091	Avionics Technicians	3		9	2	7	0.22	0	0	0	9	2	7	0	0	0
49-2092	Electric Motor, Power Tool, and Related Repairers	3		6	22	-16	3.67	6	22	-16	0	0	0	0	0	0
49-2094	Electrical and Electronics Repairers, Commercial and Industrial Equipment	3		29	39	-10	1.34	18	33	-15	11	6	5	0	0	0
49-2095	Electrical and Electronics Repairers, Powerhouse, Substation, and Relay	3		13	35	-22	2.69	8	32	-24	5	3	2	0	0	0
49-2096	Electronic Equipment Installers and Repairers, Motor Vehicles	3		2	6	-4	3.00	2	6	-4	0	0	0	0	0	0
49-2097	Electronic Home Entertainment Equipment Installers and Repairers	3		9	13	-4	1.44	6	6	0	3	7	-4	0	0	0
49-2098	Security and Fire Alarm Systems Installers	3		36	43	-7	1.19	36	43	-7	0	0	0	0	0	0
49-3011	Aircraft Mechanics and Service Technicians	3		22	10	12	0.45	14	10	4	7	1	6	0	0	0
49-3023	Automotive Service Technicians and Mechanics	3		232	465	-233	2.00	232	465	-233	0	0	0	0	0	0
49-3031	Bus and Truck Mechanics and Diesel Engine Specialists	3		106	144	-38	1.36	106	144	-38	0	0	0	0	0	0
49-3041	Farm Equipment Mechanics and Service Technicians	3		2	2	0	1.00	2	2	0	0	0	0	0	0	0
49-3042	Mobile Heavy Equipment Mechanics, Except Engines	3		38	31	7	0.82	38	31	7	0	0	0	0	0	0
49-3051	Motorboat Mechanics and Service Technicians	3		1	2	-1	2.00	0	0	0	1	2	-1	0	0	0
49-3052	Motorcycle Mechanics	3		13	3	10	0.23	0	0	0	13	3	10	0	0	0
49-9012	Control and Valve Installers and Repairers, Except Mechanical Door	3		14	1	13	0.07	14	1	13	0	0	0	0	0	0

Occupation Code	Occupation Title	Job Zone	Gap Indicator	Average Annual		S/D Ratio	Associate		Bachelor		Graduate Supply	Graduate Demand	Graduate Gap
				Demand	Supply		Demand	Supply	Demand	Supply			
49-9021	Heating, Air Conditioning, and Refrigeration Mechanics and Installers	3		131	246	1.88	131	246	0	0	0	0	0
49-9041	Industrial Machinery Mechanics	3		161	18	0.11	161	18	0	0	0	0	0
49-9043	Maintenance Workers, Machinery	3		50	6	0.12	50	6	0	0	0	0	0
49-9044	Millwrights	3		22	2	0.09	22	2	0	0	0	0	0
49-9051	Electrical Power-Line Installers and Repairers	3		72	15	0.21	72	15	0	0	0	0	0
49-9062	Medical Equipment Repairers	3		86	23	0.27	56	22	31	2	29	0	0
49-9063	Musical Instrument Repairers and Tuners	3		8	3	0.38	5	1	3	2	1	0	0
49-9071	Maintenance and Repair Workers, General	3		392	28	0.07	213	18	179	10	169	0	0
49-9092	Commercial Divers	3		4	5	1.25	2	0	2	4	-2	0	0
51-2041	Structural Metal Fabricators and Fitters	3		57	12	0.21	57	12	0	0	0	0	0
51-4011	Computer-Controlled Machine Tool Operators, Metal and Plastic	3		129	30	0.23	129	30	0	0	0	0	0
51-4012	Computer Numerically Controlled Machine Tool Programmers, Metal and Plastic	3		7	56	8.00	7	56	0	0	0	0	0
51-4041	Machinists	3		118	27	0.23	118	27	0	0	0	0	0
51-4062	Patternmakers, Metal and Plastic	3		3	5	1.67	3	5	0	0	0	0	0
51-4111	Tool and Die Makers	3		26	6	0.23	26	6	0	0	0	0	0
51-5111	Prepress Technicians and Workers	3		7	13	1.86	3	2	4	11	-7	0	0
51-5112	Printing Press Operators	3		31	22	0.71	31	22	0	0	0	0	0
51-6052	Tailors, Dressmakers, and Custom Sewers	3		14	29	2.07	4	0	10	29	-19	0	0
51-7032	Patternmakers, Wood	3		1	13	13.00	1	13	0	0	0	0	0
51-8011	Nuclear Power Reactor Operators	3		11	4	0.36	6	1	5	3	2	0	0
51-8012	Power Distributors and Dispatchers	3		13	1	0.08	13	1	0	0	0	0	0
51-8021	Stationary Engineers and Boiler Operators	3		86	33	0.38	0	0	86	33	53	0	0
51-8031	Water and Wastewater Treatment Plant and System Operators	3		44	4	0.09	44	4	0	0	0	0	0

Occupation Code	Occupation Title	Job Zone	Gap Indicator	Average Annual		S/D Ratio	Associate		Bachelor		Graduate	
				Demand	Supply		Demand	Supply	Demand	Supply	Demand	Supply
51-8092	Gas Plant Operators	3		31	3	0.10	31	3	28	0	0	0
51-9082	Medical Appliance Technicians	3		16	2	0.13	16	2	14	0	0	0
53-2012	Commercial Pilots	3		52	20	0.38	0	0	52	20	32	0
53-2021	Air Traffic Controllers	3		12	40	3.33	6	40	-34	5	1	4
53-2022	Airfield Operations Specialists	3		12	41	3.42	6	40	-34	5	1	4
53-5021	Captains, Mates, and Pilots of Water Vessels	3		18	2	0.11	0	0	18	2	16	0
53-5031	Ship Engineers	3		2	0	0.00	0	0	2	0	2	0
53-6051	Transportation Inspectors	3		2	5	2.50	0	0	2	2	5	-3

APPENDIX G: CROSSWALK OF PROGRAMS TO OCCUPATIONS

(Full List Available Upon Request)

Occupation Code	Occupation Title	Degree Code	Degree Title	NCES	PA	ACS
11-1021	General and Operations Managers	44.0401	Public Administration	•		•
		50.1001	Arts, Entertainment, and Media Management, General		•	
		50.1002	Fine and Studio Arts Management		•	
		50.1003	Music Management		•	
		50.1004	Theatre/Theatre Arts Management		•	
		52.0101	Business/Commerce, General	•		•
		52.0201	Business Administration and Management, General	•	•	•
		52.0204	Office Management and Supervision	•		
		52.0205	Operations Management and Supervision	•		
		52.0206	Non-Profit/Public/Organizational Management	•		
		52.0213	Organizational Leadership	•		
		52.0299	Business Administration, Management and Operations, Other	•		
		52.0501	Business/Corporate Communications		•	
		52.0701	Entrepreneurship/Entrepreneurial Studies	•		•
		52.0703	Small Business Administration/Management	•		
		52.0799	Entrepreneurial and Small Business Operations, Other	•		
		52.0801	Finance, General			•
		52.1101	International Business/Trade/Commerce	•		•
		52.1201	Management Information Systems, General		•	
		52.1206	Information Resources Management		•	
		52.1207	Knowledge Management		•	
		52.1299	Management Information Systems and Services, Other		•	
		52.1301	Management Science			•

Occupation Code	Occupation Title	Degree Code	Degree Title	NCES	PA	ACS
13-1161	Market Research Analysts and Marketing Specialists	45.0101	Social Sciences, General	•		
		45.0602	Applied Economics			•
		45.9999	Social Sciences, Other	•		
		52.0101	Business/Commerce, General	•		
		52.0601	Business/Managerial Economics	•		
		52.1401	Marketing/Marketing Management, General	•	•	•
		52.1402	Marketing Research	•	•	•
		52.1403	International Marketing	•	•	•
		52.1499	Marketing, Other	•	•	
		13-2011	Accountants and Auditors	43.0117	Financial Forensics and Fraud Investigation	•
45.0601	Economics, General				•	
45.0603	Econometrics and Quantitative Economics				•	
45.0605	International Economics				•	
45.0699	Economics, Other				•	
52.0101	Business/Commerce, General			•		
52.0301	Accounting			•	•	•
52.0303	Auditing			•	•	•
52.0304	Accounting and Finance			•	•	•
52.0305	Accounting and Business/Management			•	•	•
52.0399	Accounting and Related Services, Other			•	•	
52.0601	Business/Managerial Economics				•	
52.0801	Finance, General			•	•	
52.0804	Financial Planning and Services				•	
52.0807	Investments and Securities				•	
52.0899	Finance and Financial Management Services, Other			•	•	
52.1304	Actuarial Science				•	
52.1601	Taxation			•		•
15-1121	Computer Systems Analysts	11.0101	Computer and Information Sciences, General	•		•
		11.0103	Information Technology	•		•
		11.0501	Computer Systems Analysis/Analyst	•	•	•
		11.0701	Computer Science		•	
		11.0801	Web Page, Digital/Multimedia and Information Resources Design	•	•	
		11.0803	Computer Graphics		•	
		11.0804	Modeling, Virtual Environments and Simulation		•	

Occupation Code	Occupation Title	Degree Code	Degree Title	NCES	PA	ACS
		11.0899	Computer Software and Media Applications, Other		•	
		11.0901	Computer Systems Networking and Telecommunications			•
		52.1201	Management Information Systems, General	•		
		52.1207	Knowledge Management	•		
		52.1299	Management Information Systems and Services, Other	•		
29-1141	Registered Nurses	51.0000	Health Services/Allied Health/Health Sciences, General	•	•	
		51.0704	Health Unit Manager/Ward Supervisor	•	•	
		51.3801	Registered Nursing/Registered Nurse	•	•	•
		51.3803	Adult Health Nurse/Nursing	•	•	•
		51.3805	Family Practice Nurse/Nursing	•	•	•
		51.3808	Nursing Science	•	•	•
		51.3818	Nursing Practice	•	•	•
		51.3899	Registered Nursing, Nursing Administration, Nursing Research and Clinical Nursing, Other	•	•	•